IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY

ADVANCED MIXED WASTE TREATMENT PROJECT

CERTIFICATION PLAN FOR INEEL CONTACT-HANDLED TRANSURANIC WASTE

BNFL INC.

3/18/03
Approved (Signature/Date)

Next Periodic Review 08/01/05

DOCUMENT APPROVAL SHEET

Document Type : Compliance Plan **Document Number:** MP-TRUW-8.1

Title : Certification Plan for INEEL Contact-Handled Transuranic Waste

Author: Gina Tedford **Phone:** 208 557-7120

Document Owner: Eric Schweinsberg **Phone:** 208 557-7164

REVIEW CONCURRENCE AND APPROVAL SIGNATURES

Denote R for review concurrence, A for approval, as appropriate.

Type or print name / Signature	R/A	Date	Organization Discipline	Mailing Address
Gina K. Tedford Gina K Tedford	R	3/17/03	Waste Certification Official	765 Lindsay Blvd. Idaho Falls, ID 83402
Don Pound	R	3/17/03	Transporation Certification Official	765 Lindsay Blvd. Idaho Falls, ID 83402
Elvin Dumas	R	3/17/03	Site Quality Assurance Officer	775 Lindsay Blvd. Idaho Falls, ID 83402
Eric Schweinsberg	R	3/17/03	Site Project Manager	765 Lindsay Blvd. Idaho Falls, ID 83402
Brian Edgerton Brian N. Edgerton	A	3/17/03	DOE-ID AMWTP Project Manager	850 Energy Drive Idaho Falls, ID 83401
Ava Holland for AH	A	5/20/03 Approved per KW letter see below	Manager, CBFO Quality Assurance	DOE-CBFO Carlsbad, NM 88221
Kerry Watson	A	Approved by Memo 4/3/03 CBFO:NTP:KWW: VW:03-1643: VEC:5822 KWW 5/20/03	DOE-CBFO	DOE-CBFO Carlsbad, NM 88221

REVISION LOG

Revision Number	Date Approved	Pages Affected	Description of Revision
0	08/01/02	All	Initial issue. DCR-1230. Document issue date was 07/17/02. DOE/WIPP approval was received 07/30/02 thus the change in effective date to 08/01/02.
1	12/19/02	Various	DCR-1820. Correct procedure titles and numbers. Added verbiage to include manual data review. Added DOE-ID to the Document Approval Sheet in accordance with MP-DOCS-18.4. Document issue date was 12/19/02. DOE/WIPP approval was received 01/14/03 thus the change in effective date to 02/06/03.
2	06/11/03	Various	DCR-2117: Incorporate WIPP WAC Rev. 0.1 and QAPD Rev. 4 requirements. Correct procedure references in Section 4. Document issue date was 03/20/03. DOE/WIPP approval was received 04/03/03. The original signature page was lost and was resigned, thus the change in effective date is 06/11/03.

TABLE OF CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS

AEA	Atomic Energy Act
ACMM	Analytical Chemistry Methods Manual
AK	acceptable knowledge
ALD	Analytical Laboratories Department
AMWTF	Advanced Mixed Waste Treatment Facility
AMWTP	Advanced Mixed Waste Treatment Project
ASTM	American Society for Testing and Materials
ANSI	American National Standards Institute
CAR	Corrective Action Report
CBFO	Carlsbad Field Office
CCA	Compliance Certification Application
CFR	Code of Federal Regulations
CH	contact-handled
CH-TRU	contact-handled TRU waste
CH-WAC	contact-handled waste acceptance criteria
Ci	curie
CPR	cellulose, plastic, and rubber
DAS	drum assay system
DDA	differential die-away
DCR	document change request
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DR	Deficiency Report
DSDD	detailed software design description
DQO	data quality objective
EDF	Engineering Design File
EPA	U.S. Environmental Protection Agency
FGE	fissile gram equivalent
FRC	Federal Records Center
HSGS	headspace gas sampling
ID	Idaho
INEL	Idaho National Engineering Laboratory
INEEL	Idaho National Engineering and Environmental Laboratory
INST	Instruction
LCS	laboratory control sample
LLD	lower limit of detection
LWA	Land Withdrawal Act
MP	Management Procedure

MS	matrix spike
MSD	matrix spike duplicate
nCi/g	nanocuries per gram
NCR	nonconformance report
NDA	nondestructive assay
NIST	National Institute of Standards and Technology
NMED	New Mexico Environment Department
NMMA	nuclear material management area
NRC	U.S. Nuclear Regulatory Commission
OPCTCD	overpack payload container transportation certification document
PATCD	payload assembly transportation certification document
PCTCD	payload container transportation certification document
PCB	polychlorinated biphenyl
PDAS	In-plant Drum Assay System
PDP	performance demonstration program
PE-Ci	plutonium-239 equivalent curies
QA	quality assurance
QAO	quality assurance objective
QAP	Quality Assurance Plan
QAPD	Quality Assurance Program Document
QAPjP	quality assurance project plan
QC	quality control
RC	radiochemistry
RCRA	Resource Conservation and Recovery Act
RDAS	retrieval drum assay system
RH	remote-handled (waste)
RIDS	records inventory and disposition schedule
%R	percent recovery
RPD	relative percent difference
RSD	relative standard deviation
RT	Radiological Technician
RTR	real-time radiography
SAR	Safety Analysis Report
SATR	Site Acceptance Test Reports
SNM	special nuclear material
SPM	Site Project Manager
SPO	Site Project Office
SQAO	Site Quality Assurance Officer
SWB	standard waste box
TCO	Transportation Certification Official

TDOP	ten-drum overpack
TMU	total measurement uncertainty
TRAMPAC	TRUPACT-II Authorized Methods for Payload Control
TRU	transuranic
TRUCON	TRUPACT-II Content Codes
TRUPACT-II	Transuranic Package Transporter-Model II
TSDF	Treatment, Storage, and Disposal Facility
VE	Visual Examination
VOC	volatile organic compound
WAC	Waste Acceptance Criteria
WAP	Waste Analysis Plan
WCL	waste component limits
WCO	Waste Certification Official
WIPP	Waste Isolation Pilot Plant
WSPF	Waste Stream Profile Form
WTS	Waste Tracking System
WWIS	WIPP Waste Information System

Certification Plan for INEEL Contact-Handled Transuranic Waste

1.0 INTRODUCTION

The purpose of this document is to summarize the methods and procedures used by the Idaho National Engineering and Environmental Laboratory (INEEL) Advanced Mixed Waste Treatment Project (AMWTP) to certify defense generated waste as compliant to the waste acceptance criteria applicable to the transportation, storage, and disposal of contact-handled transuranic (CH-TRU) waste at the Waste Isolation Pilot Plant (WIPP). These criteria serve as the U.S. Department of Energy's (DOE) primary directive for ensuring that CH-TRU waste is managed and disposed of in a manner that protects human health and safety and the environment.

The authorization basis of WIPP for the disposal of CH-TRU waste includes the U.S. Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980 (reference 20) and the WIPP Land Withdrawal Act (LWA; reference 21). Included in this document are the requirements and associated criteria imposed by these acts and the Resource Conservation and Recovery Act (RCRA, reference 22), as amended, on the TRU waste destined for disposal at WIPP.

The AMWTP must certify CH-TRU waste payload containers to the contact-handled waste acceptance criteria (CH-WAC) identified in this document. As shown in figure 1.0, the flow-down of applicable requirements to the CH-WAC is traceable to several higher-tier documents, including the WIPP operational safety requirements derived from the WIPP CH Safety Analysis Report (SAR; reference 14), the transportation requirements for CH-TRU wastes derived from the Transuranic Package Transporter-Model II (TRUPACT-II) Certificate of Compliance (reference 43), the WIPP LWA (reference 21), the WIPP Hazardous Waste Facility Permit (reference 42), and the U.S. Environmental Protection Agency (EPA) Compliance Certification Decision (reference 27). The solid arrows shown in figure 1.0 represent the flow-down of all applicable payload container-based requirements. The two dotted arrows shown in figure 1.0 represent the flow-down of summary level requirements only; i.e., the sites must reference the regulatory source documents from the U.S. Nuclear Regulatory Commission (NRC) and the New Mexico Environment Department (NMED) for a comprehensive and detailed listing of the requirements.

The Certification Plan for INEEL Contact-Handled Transuranic Waste, also referred to as the Certification Plan, does not address requirements or shippability of waste in DOE Type B casks or the subject of waste characterization relating to a determination of whether the waste is hazardous; rather, the AMWTP refers to the Waste Analysis Plan (WAP) contained in the WIPP Hazardous Waste Facility Permit for details of the sampling and analysis protocols to be used in determining compliance with the required physical and chemical properties of the waste. Requirements and associated criteria pertaining to a determination of the radiological properties of the waste, however, are addressed in appendix A of this document. The collective information obtained from waste characterization records and acceptable knowledge (AK) serves as the basis for sites to certify that their CH-TRU waste satisfies the WIPP CH-WAC.

Section 2.0 of this document identifies the responsible organizations and associated activities for ensuring that the CH-TRU waste is managed in a manner that protects human health and safety and the environment.

Section 3.0 identifies the authorization basis of the requirements and lists the associated waste acceptance criteria and compliance methods relating to the physical, chemical, and radiological attributes of the waste as well as the properties of the applicable containers themselves.

Section 4.0 summarizes the AMWTP Quality Assurance (QA) requirements relating to waste characterization, certification, and transportation that meet all applicable requirements of the Carlsbad Field Office (CBFO) *Quality Assurance Program Document* (QAPD; reference 7). Characterization of CH-TRU waste must be in accordance with the performance requirements of the WIPP WAP and is implemented in the AMWTP Quality Assurance Project Plan (QAPjP). Certification of payload containers for shipment in the TRUPACT-II shall be performed under a CBFO approved QA program that provides confidence for both the shipper and the receiver that the TRUPACT-II Authorized Methods for Payload Control (TRAMPAC; reference 45) requirements have been met.

The appendices provide supplemental information relating to radioassay (appendix A) and radiotoxic inhalation hazard analyses (appendix B). A glossary is provided in appendix C. Appendix D addresses the visual examination requirements and compliance criteria for payload containers.

The CH-WAC is a controlled document. The most current version of the CH-WAC (including any Interim Changes) is available for downloading from the CBFO Web Page at http://www.wipp.ws/library/wac/ch-wacrev0.pdf. This Internet link is provided for informational purposes only and may change.

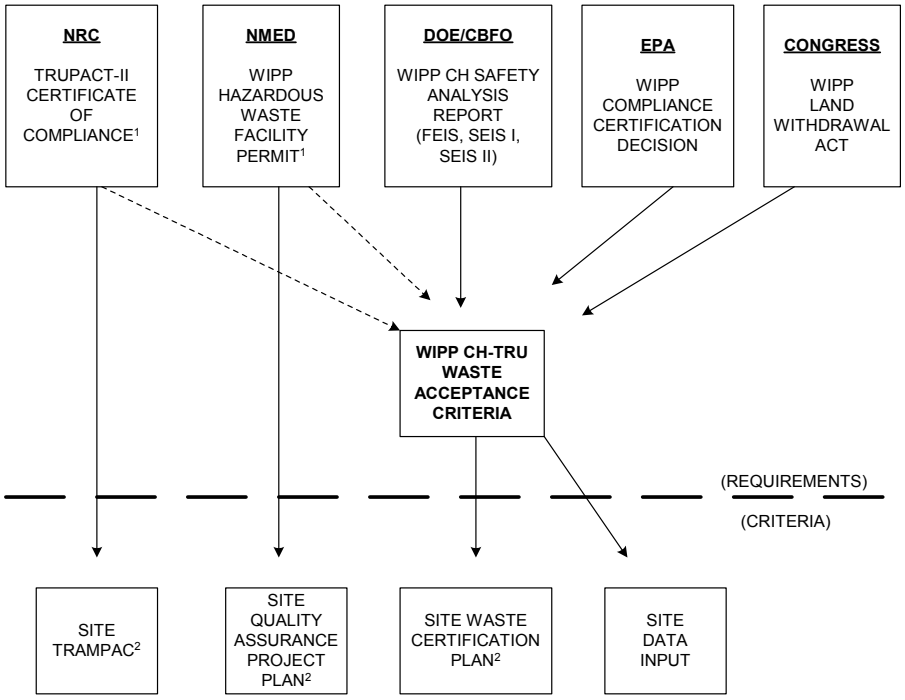

Figure 1.0 Regulatory Basis of CH-TRU Waste Acceptance Criteria

Note 1: The TRAMPAC and the WIPP Hazardous Waste Facility Permit provide detailed requirements. The CH-WAC only provides an overview of these requirements.

Note 2: All work performed by the site for the CBFO must be performed under an approved QA program.

2.0 RESPONSIBILITIES

This section identifies the responsibilities of organizations that develop and approve the WIPP CH-WAC and of those that oversee the implementation of the requirements defined herein. The responsibilities of the AMWTP to which these requirements apply are also identified in this section.

2.1 DOE Headquarters

The Assistant Secretary for Environmental Management (EM-1) provides policy and guidance for DOE environmental management sites, facilities, and operations.

2.2 DOE Carlsbad Field Office

The CBFO is responsible for the day-to-day management and direction of strategic planning and related activities associated with the characterization, certification, transportation, and disposal of defense TRU waste. The CBFO holds the applicable permits, certifications, and records of decision necessary for the operation and closure of the WIPP facility.

The CBFO assists the sites in resolving issues about the management of TRU waste as requested. The CBFO provides policy and oversight direction for TRU waste program activities related to site certification of waste for disposal at WIPP. The CBFO is also responsible for the following:

- Ensuring that the sites prepare implementation documentation and programs to meet the requirements and criteria in the CH-WAC

- Overseeing activities associated with the
  -characterization and certification of CH-TRU waste
  -proper use of approved transportation packaging
  -receipt, management, and disposal of CH-TRU waste in WIPP

- Providing a fleet of NRC-approved Type B transportation packages for shipment of CH-TRU waste from the sites to WIPP

- Ensuring that CH-TRU waste accepted for management and disposal at WIPP complies with the WIPP Hazardous Waste Facility Permit, applicable laws, and regulations as described in this CH-WAC

- Reviewing and approving proposed revisions to the CH-WAC to ensure that environmental impacts associated with any revision are bounded by existing WIPP National Environmental Policy Act documentation including the Final Environmental Impact Statement (reference 10), Final Supplemental Environmental Impact Statement I (reference 11), and the Final Supplemental Environmental Impact Statement II (reference 12)

- Reviewing and approving the site's waste certification plan, TRAMPAC, QA plan, and QAPjP

- Performing site certification audits and surveillances

- Granting transportation and waste certification authority to sites

2.3 DOE Field Elements

Each DOE Field Element is responsible for overseeing the management of the site TRU waste program in compliance with established CBFO requirements, policies, and guidelines, and for providing liaison between the CBFO and the management and operating contractors.

2.4 TRU Waste Sites

The AMWTP is responsible for developing and implementing site-specific TRU waste program documents (plans) that address applicable requirements and criteria pertaining to packaging, characterization, certification, and shipping of defense TRU waste to WIPP for disposal. Methods of compliance with each requirement and associated criterion to be implemented is described or specifically referenced and include procedural and administrative controls consistent with the CBFO QAPD. The AMWTP will certify that each CH-TRU waste payload container meets the waste acceptance criteria contained in section 3. The AMWTP QA requirements relating to waste characterization, certification, and transportation are contained in section 4.0. The following AMWTP site-specific TRU waste program documents will be submitted to CBFO for review and approval prior to implementation:

- MP-TRUW-8.1, Certification Plan for INEEL Contact-Handled Transuranic Waste

- MP-TRUW-8.2, Quality Assurance Project Plan (QAPjP)

- MP-TRUW-8.3, TRUPACT-II Authorized Methods for Payload Control (TRAMPAC)

The AMWTP TRU Program organization, project level positions, and their primary responsibilities are described in Section 4.4.1 of this document.

3.0 WIPP WASTE ACCEPTANCE REQUIREMENTS AND CRITERIA

The requirements and associated criteria for acceptance of defense TRU waste at WIPP for disposal are identified in the CH-WAC. The acceptance criteria of the CH-WAC describe the controlling (i.e., the most restrictive) requirements to be used by the AMWTP in preparing their waste for transportation to and disposal at the WIPP. In some instances the acceptance criteria and regulatory requirements are synonymous. The CH-WAC requirements are derived from several source documents: the WIPP Safety Analysis Report (reference 14), the TRUPACT-II Certificate of Compliance (reference 43), the WIPP LWA (reference 21), the WIPP Hazardous Waste Facility Permit (reference 42), and the Compliance Certification Decision (reference 27). Definitions of terms used in the CH-WAC are included in Appendix C.

3.1 Summary of WIPP Authorization Basis

The purpose of section 3.0 is to present the requirements and associated criteria that must be met for CH-TRU waste to be transported to, managed at, and disposed of in the WIPP. The requirements and associated criteria are organized under five major headings: Container Properties, Radiological Properties, Physical Properties, Chemical Properties, and Data Package Contents. Only CH-TRU waste from a properly characterized and approved waste stream may be certified as meeting the requirements and associated criteria contained in this CH-WAC. Any waste payload container from a waste stream that has not been preceded by an appropriate certified Waste Stream Profile Form (WSPF) is not acceptable for disposal at WIPP (reference 42, module II, section II.C.3.k).

Site-specific plans and procedures shall contain details of the processes, controls, techniques, tests, and other actions to be applied to each TRU payload container, waste stream, and shipment. Methods of compliance with each requirement shall be described and the specific procedure cited. These methods of compliance shall include procedural controls, administrative controls, and waste generation process controls. The QA requirements applicable to waste characterization, certification, and transportation are addressed in various sections of this CH-WAC and are briefly summarized in section 4.0. The data resulting from the implementation of the plans and procedures will form the basis for verifying that CH-TRU waste to be sent to WIPP is certified to meet the CH-WAC by the responsible site certifying official(s).

Sites shall transmit required characterization, certification, and shipping data to WIPP using the WIPP Waste Information System (WWIS). The WWIS is an electronic database equipped with edit/limit checks to ensure that the data representing the waste payload containers are in compliance with this CH-WAC. The WWIS also incorporates the automated TRUPACT-II Authorized Methods for Payload Control (e-TRAMPAC) software, which is used to evaluate containers and assemblies of CH-TRU waste for compliance with each of the TRAMPAC requirements. Before shipping TRU waste payload containers from a WIPP-accepted waste stream, the site shall transmit the required waste characterization, certification, and shipping data via WWIS to WIPP. Sites may periodically be requested to transmit payload container radiography reports or other data to WIPP. WIPP will not accept any waste shipments for disposal if the waste payload container information has not been correctly submitted and approved for shipment by the WWIS Data Administrator. The WWIS User's Manual (reference 9) provides the information needed by TRU waste sites to perform tasks associated with transmittal of the payload container's characterization, certification, and shipment information to WIPP.

Sites will be notified of revisions to external regulatory requirements by CBFO. Revisions of requirements in referenced documents not controlled by the DOE (but by, for example, the EPA, NRC, or NMED) shall have precedence over the values specified here if they are more restrictive. These changes will be incorporated in future revisions of the CH-WAC.

3.1.1 DOE Operations and Safety Requirements for WIPP

The WIPP SAR (reference 14) addresses CH-TRU waste handling and emplacement operations. The waste accepted for emplacement in the WIPP must conform to the SAR and the associated technical safety requirements (reference 15). The SAR documents the safety analyses that develop and evaluate the adequacy of the WIPP safety bases necessary to ensure the safety of workers, the public, and the environment from the hazards posed by WIPP waste receiving, handling, and emplacement operations. The SAR establishes and evaluates the adequacy of the safety bases in response to plant normal and abnormal operations and postulated accident conditions.

3.1.2 NRC Transportation Safety Requirements for the TRUPACT-II

Acceptable methods for payload compliance are defined in the TRUPACT-II Certificate of Compliance and implemented by the TRAMPAC (reference 45). For shipments to WIPP, each site must prepare a site-specific TRAMPAC describing how it will ensure compliance with each payload parameter. This technical plan shall contain sufficient detail to allow reviewers to adequately understand and evaluate the compliance methodology for each payload parameter.

Sites shall have a packaging QA program that defines the QA activities that apply to the use of NRC-approved transportation packaging equivalent to Title 10 of the Code of Federal Regulations (10 CFR) Part 71, Subpart H. (reference 29)

3.1.3 NMED Hazardous Waste Facility Permit Requirements

TRU waste is classified as TRU mixed waste if it contains hazardous constituents regulated under the New Mexico Hazardous Waste Act. Only TRU mixed waste and TRU waste that have been characterized in accordance with the WIPP WAP and that meet the treatment, storage, and disposal facility (TSDF) waste acceptance criteria as presented in permit conditions II.C.3.a through II.C.3.k of the WIPP Hazardous Waste Facility Permit will be accepted at the WIPP facility for disposal in the permitted underground hazardous waste disposal unit.

Prior to disposal, each participating site shall develop and implement a QAPjP that addresses all the applicable requirements specified in the WIPP WAP. In accordance with attachment B5 of the WIPP WAP, the QAPjP will include the qualitative or quantitative criteria for making a hazardous waste determination. All site QAPjPs will be reviewed and approved by the CBFO.

3.1.4 EPA Compliance Certification Decision Requirements

Title 40 CFR § 194.24(c) states that the DOE shall specify the limiting values for waste components to be emplaced in the repository (reference 33). Appendix WCL (Waste Component Limits) of the Compliance Certification Application (CCA; reference 8) identifies the repository limits for several waste components including free water, metals, and cellulose, plastic, and rubber (CPR). Although the CCA does not specifiy limiting values for the activities and masses of specific radionuclides. Table 4-6 of the CCA identifies the listed values for a number of radionuclides that are considered in the Performance Assessment. To demonstrate that the cumulative total activities of the specified radionuclides (^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs) are consistent with the levels used for the Performance Assessment and the compliance certification decision, reporting, and tracking of the specified radionuclides (^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs) is necessary, as required by Table 4-10 of the CCA. TRU waste payload containers shall contain more than 100 nanocuries per gram of waste (nCi/g) of alpha-emitting TRU isotopes with half-lives greater than 20 years, as specified in section 3.3.3 of the CH-WAC.

The repository limit for free water is a maximum of 1684 m^3 and is met by the residual liquid criterion specified in section 3.4.1 of the CH-WAC.

The limits for metals are a minimum of 2 X 10^7 kg for ferrous metals and 2 X 10^3 kg for nonferrous metals. These limits will be met in the total repository inventory by the metals that constitute the payload containers alone; thus, WIPP tracks the number and type of payload containers emplaced in the repository as reported in the WWIS by the sites (see section 3.2.1).

The repository limit for CPR is a maximum of 2 X 10^7 kg. Sites are required to estimate the CPR weights and report these estimates in the WWIS on a payload container basis as required by section 3.6.1. Waste generators must quantify and report the activities and masses of specific radionuclides for the purpose of tracking the total radionuclide inventory of the repository as specified in section 3.3.1 of the CH-WAC. The presence or absence of these specific radionuclides is determined from AK, radioassay, or both in accordance with appendix A of the CH-WAC. The results of this determination are reported in the WWIS on a payload container basis.

3.1.5 Land Withdrawal Act Requirements

The term "WIPP" means the Waste Isolation Pilot Plant project authorized under section 213 of the Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980 (Pub. L. 96-164; 93 Stat. 1259-1265) to demonstrate the safe disposal of radioactive waste materials generated by atomic energy defense activities (reference 20, section 2[19]). Hence, by law, WIPP can accept only radioactive waste generated by atomic energy defense activities of the United States (reference 21, section 2[19]).

The DOE and its predecessor agencies were engaged in a broad range of activities that fall under the heading of atomic energy defense activities. A TRU waste is eligible for disposal at WIPP if it has been generated in whole or in part by one or more of the following functions (references 23 and 24):

- Naval reactors development
- Weapons activities, including defense inertial confinement fusion
- Verification and control technology
- Defense nuclear materials productions
- Defense nuclear waste and materials by-products management
- Defense nuclear materials security and safeguards and security investigations
- Defense research and development

Using AK, DOE sites must determine that each waste stream to be disposed of at WIPP is "defense" TRU waste.

High-level radioactive waste or spent nuclear fuel shall not be transported, emplaced, nor disposed of at WIPP (reference 20, section 12). Also, no transuranic waste may be transported by or for the DOE to or from WIPP, except in packages (1) the design of which has been certified by the NRC, and (2) that have been determined by the NRC to satisfy its quality assurance requirements (reference 21, section 16).

3.2 Container Properties

3.2.1 Description

Acceptance Criterion. Each payload container shall be assigned to a payload shipping category. (reference 45, section 5.1) Authorized payload containers include:

- 55-gallon drums (either direct loaded or containing a pipe component)
- Standard waste boxes (SWBs, either direct loaded, or containing up to four direct loaded 55-gallon drums, or containing one bin)
- Ten drum overpacks (TDOPs, either containing up to ten direct loaded 55-gallon drums, six 85-gallon drum overpacks, or one SWB)

Payload containers shall meet U.S. Department of Transportation (DOT) Specification 7A, Type A, packaging requirements (reference 15, section 5.9.12; reference 42, attachment M1, section M1-1b). Payload containers must be made of steel and be in good and unimpaired condition prior to shipment from the generator/storage sites. To demonstrate compliance with the requirement that payload containers be in good and unimpaired condition, the exterior of all payload containers shall undergo 100% visual examination (VE) prior to loading into a TRUPACT-II. The results of this visual examination shall be documented using the payload container integrity checklist contained in appendix D. A payload container in good and unimpaired condition 1) does not have significant rusting, 2) is of sound structural integrity, and, 3) does not leak. Significant rusting is a readily observable loss of metal due to oxidation (e.g., flaking, bubbling, or pitting) that causes degradation of the payload container's structural integrity. Rusting that causes discoloration of the payload container surface or consists of minor flaking is not considered significant. A payload container is not of sound structural integrity if it has breaches or significant denting/deformation. Breaching is defined as a penetration in the payload container that exposes the internals of the container. Significant denting/deformation is defined as damage to the payload container that results in creasing, cracking, or gouging of the metal, or damage that affects payload container closure. Dents or deformations that do not result in creasing, cracking, or gouging or affect payload container closure are not considered significant. Generator sites will report to the WWIS the number and types of payload containers planned for shipment to the WIPP (reference 8, appendix WCL).

Compliance: Each payload container is assigned a shipping category and is verified in the WTS or WIPP Waste Information System (WWIS). Authorized payload containers are controlled and verified in accordance with work instruction, INST-OI-21, *TRUPACT-II Payload Assembly.* Payload container visual inspections detailed in Appendix D are performed and documented per work instruction, INST-OI-21, *TRUPACT-II Payload Assembly*. Payload containers that do not meet the container integrity visual examination are overpacked prior to shipment. The numbers and types of payload containers planned for shipment to WIPP are reported the WWIS in accordance with management procedure, MP-TRUW-8.16, *WWIS Data Transfer*.

3.2.2 Weight Limits and Center of Gravity

Acceptance Criterion. Each payload container, payload assembly, and loaded TRUPACT-II shall comply with the weight limits shown in table 3.2.2. Weight calculations for the payload assembly must include the measurement error. The total weight of the top seven 55-gallon drums or SWB of the payload assembly shall be less than or equal to the total weight of the bottom seven 55-gallon drums or SWB, respectively. The total weight of the top five 55-gallon drums or three 85-gallon drum overpacks in a TDOP shall be less than or equal to the total weight of the bottom five 55-gallon drums or three 85-gallon drum overpacks, respectively. Calibrations of the scales used to make these weight determinations shall be in accordance with the National Institute of Standards and Technology (NIST) Handbook 44, *Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices*, or an equivalent standard. (reference 45, section 2.3; reference 41)

Table 3.2.2
Weight Limits

Container	Maximum Gross Weight (lbs)
55-gallon drum	≤ 1,000
55-gallon drum containing a six-inch-diameter standard pipe component (i.e., a standard pipe overpack)	≤ 328
55-gallon drum containing a twelve-inch-diameter standard pipe component (i.e., a standard pipe overpack)	≤ 547
55-gallon drum containing an S100 pipe component (i.e., an S100 pipe overpack)	≤ 650
55-gallon drum containing an S200 pipe component (i.e., an S200 pipe overpack)	≤ 547
SWB	≤ 4,000
TDOP	≤ 6,700
Payload assembly of fourteen 55-gallon drums	≤ 7,265
Payload assembly of two SWBs	≤ 7,265
TRUPACT-II	≤ 19,250
Truck (tractor/trailer)	≤ 80,000

Compliance: Each drum is weighed on a calibrated scale at one of the drum assay systems (DAS) in accordance with work instruction, INST-OI-14, *Drum Assay Operations* The payload container weight is evaluated by the WTS or WWIS for compliance with the requirement listed in Table 3.2.2. This evaluation compares the payload container weight including its associated measurement error (expressed in terms of one standard deviation). Calibrations of the scales are done in accordance with the NIST Handbook 44, *Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices,* or an equivalent standard. The weight is reported to the WWIS in accordance with management procedure, MP-TRUW-8.16, *WWIS Data Transfer.*

Additional weight limits may be implemented based on restrictions identified by procurement specifications and testing. These restrictions will also be addressed in the applicable work instructions as they are identified.

The WTS or WWIS evaluates the TRUPACT-II payload assembly for compliance with the weight requirements using the location and weight of the individual payload containers. The total weight of the top seven 55-gallon drums or SWB of the payload assembly is less than or equal to the total weight of the bottom seven 55-gallon drums or SWB, respectively. The total weight of the top five 55-gallon drums or three 85-gallon drum overpacks in a TDOP is be less than or equal to the total weight of the bottom five 55-gallon drums or three 85-gallon drum overpacks, respectively. Evaluations of the TRUPACT-II and truck weights for compliance with the requirements listed in Table 3.2.2 are performed using the calculated payload assembly weights, reported TRUPACT-II weights, and the reported truck weight. Work Instructions, INST-OI-20, *TRUPACT-II Operations*, and INST-OI-21, *TRUPACT-II Payload Assembly,* ensure compliance.

3.2.3 Assembly Configurations

Acceptance Criterion. Payload container assembly configurations authorized for shipment in the TRUPACT-II shall be in accordance with table 3.2.3.

Table 3.2.3
Payload Container Assembly Configurations

Number of Payload Containers in Assembly	Payload Container Configuration
14	55-gallon drums
14	55-gallon drums, each containing one standard pipe component
14	55-gallon drums, each containing one S100 pipe component
14	55-gallon drums, each containing one S200 pipe component
2	SWBs
2	SWBs, each containing one bin
2	SWBs, each containing up to four 55-gallon drums
1	TDOP containing up to 10 55-gallon drums
1	TDOP containing up to six 85-gallon drums (each 85-gallon drum containing one 55-gallon drum)
1	TDOP containing one SWB
1	TDOP containing one bin within an SWB
1	TDOP containing up to four 55-gallon drums within an SWB

Although 85-gallon drum overpacks are acceptable at WIPP, they are not authorized for transport in a TRUPACT-II as individual payload containers.

Compliance: Work instruction, *INST-OI-21, TRUPACT-II Payload Assembly,* controls the maximum number of containers per TRUPACT-II and the authorized packaging configurations.

3.2.4 Removable Surface Contamination

Acceptance Criterion. Removable surface contamination on CH-TRU waste payload containers, payload assemblies, and packaging shall not exceed 20 dpm/100 cm^2 alpha and 200 dpm/100 cm^2 beta-gamma (reference 15, section 5.9.12; reference 42, attachment M1, section M1-1d[2]; reference 37; and reference 31). The fixing of surface contamination to meet these criteria is not allowed by WIPP in accordance with best management practices for ensuring worker radiation dose as low as reasonable achievable.

Compliance: A radiological technician (RT) surveys each container which is documented per the work instruction, INST-OI-21, *TRUPACT-II Payload Assembly*. Containers that exceed allowable surface contamination levels are decontaminated and/or overpacked. Surveys on the loaded TRUPACT-II are performed in accordance with work instructions, INST-0I-20, *TRUPACT-II Operations*. Results are reported to the WWIS in accordance with management procedure, MP-TRUW-8.16, *WWIS Data Transfer.*

3.2.5 Identification/Labeling

Acceptance Criterion. Each payload container shall be labeled with a unique container identification number using bar code labels permanently attached in conspicuous locations. The payload container identification number shall be in medium to low density Code 39 bar code symbology as required by American National Standards Institute (ANSI) standard ANSI/AIM BC1-1995 (reference 40) in characters at least one inch high and alphanumeric characters at least one-half inch high. In the case of 55-gallon drums, the bar code identification labels shall be placed at three locations approximately 120 degrees apart so that at least one label is clearly visible when the drums are assembled into a seven-pack (i.e., a label must be visible after slip sheets and wrapping are applied). In the case of SWBs, bar code labels are required on the flat sides of the SWB (reference 4). For TDOPs, a minimum of one bar code is required.

Payload containers shall be marked "Caution Radioactive Material" using a yellow and magenta label as specified in 10 CFR Part 835 (reference 31). Those payload containers whose contents are also RCRA regulated (mixed-TRU) shall be additionally marked "Hazardous Waste" as specified in 40 CFR § 262.32 (reference 34).

If an empty 55-drum is used as dunnage to complete a payload configuration, the dunnage container shall be labeled with the following information:

- Unique container identification number
- "EMPTY" or "DUNNAGE

If a seven-pack of only dunnage 55-gallon drums or a dunnage SWB is used in the TRUPACT-II, the container(s) shall be labeled only "EMPTY" or "DUNNAGE." The unique container identification number label is not required for a seven-pack of dunnage, 55-gallon drums, or a dunnage SWB. (reference 45, section 2.4.1)

Compliance: Payload containers certified for shipment by the AMWTP, are labeled in medium to low density Code 39 bar code symbology as required by American National Standards Institute (ANSI) standard ANSI/AIM BC1-1995 (reference 40) in characters at least one inch high and alphanumeric characters at least one-half inch high in the following format: BNXXXXXXXXXXX, where BN represents BNFL, Inc. AMWTP and XXXXXXXXXXX represents a sequential number generated by the WTS. The WTS also verifies that the identification number is unique and that a duplicate container identification number does not exist. Empty containers used as dunnage are labeled "EMPTY" or "DUNNAGE".

Payload containers are marked "Caution Radioactive Material" using a yellow and magenta label as specified in 10 CFR Part 835 (reference 31). Those payload containers whose contents are also RCRA regulated (mixed-TRU) are additionally marked "Hazardous Waste".

55-gallon drums are labeled as they are retrieved from storage in accordance with Work Instruction, INST-OI-09, *Retrieval Enclosure Waste Container Extraction*, or Work Instruction, INST-OI-11, *Waste Container Handling.*

Work instruction, INST-OI-21, *TRUPACT-II Payload Assembly,* prepares the labels used when containers are placed into a TDOP or SWB and ensure that labels attached to all payload containers are correct prior to shipment.

3.2.6 Dunnage

Acceptance Criterion. A shipper shall use empty 55-gallon drums or a SWB as dunnage to complete a payload configuration if too few payload containers are available that meet transportation requirements. The dunnage container(s) must meet the specifications of appendix 2.1 of the TRAMPAC with the exception that dunnage containers shall have open vent ports (i.e., not filtered or plugged). (reference 45, section 2.2.1)

To maximize the efficiency of disposal operations at the WIPP, the use of dunnage drums should be minimized. In the event the use of dunnage drums cannot be avoided, the preferred practice for maximizing the efficiency of waste handling and the utilization of disposal room capacity is to ship them in assemblies (i.e., a seven-pack assembly of 55-gallon drums). The use of dunnage drums is reviewed and approved concurrently with the review and approval of shipment assemblies by the WWIS Data Administrator on a case-by-case basis.

Compliance: Work Instruction, INST-OI-21, *TRUPACT-II Payload Assembly*, verifies that empty 55-gal drums or SWBs used, as dunnage to complete payload configurations are labeled “Empty” or “Dunnage”. Dunnage containers are inspected in accordance with Work Instruction, INST-OI-21, *TRUPACT-II Payload Assembly,* to demonstrate compliance with the U.S. Department of Transportation (DOT) Specification 7A, Type A, packaging requirements(reference 15, section 5.9.12; reference 42, attachment M1, section M1-1b) that payload containers be in good and unimpaired condition, the exterior of all payload containers are inspected prior to loading into a TRUPACT-II. Payload containers are also inspected to ensure that containers have open vent ports (i.e., not filtered or plugged). These containers are reported in the WWIS in accordance with management procedure, MP-TRUW-8.16, *WWIS Data Transfer*.

3.2.7 Filter Vents

Acceptance Criterion. Payload containers that have been stored in an unvented condition (i.e., no filter and/or unpunctured liner) shall be aspirated for a specific length of time as described in the TRAMPAC to ensure equilibration of any gases that may have accumulated in the closed payload container. (reference 45, section 5.3.1 and appendix 5.9)

Each payload container shall have one or more filter vents that meet the specifications of appendix 2.5 of the TRAMPAC (reference 15, section 5.9.12; reference 45, section 2.5.1). The model number of each filter vent or combination of filter vents installed on a payload container shall be reported to the WWIS. A listing of available CBFO filter vent models is provided on the CBFO Web Page (http://www.wipp.ws/transport.htm). This Internet link is provided for informational purposes only and may change.

Compliance: QA procedures provide protocol for procuring and inspecting filters to ensure compliance with appendix 2.5 of the TRAMPAC specifications for filter vents, which are performed in accordance with management procedure, MP-PCMT-15.3, *Purchase Order/Subcontract Preparation and Control* and MP-Q&SI-5.7, *Quality Inspections.*

Payload containers that have been stored in an unvented condition (i.e., no filter and/or unpunctured) liner are vented and aspirated in accordance with work instruction, INST-OI-13, *Drum Vent/Headspace Gas Sample Operations.*

Work instruction, INST-OI-21, *TRUPACT-II Payload Assembly,* verifies that each payload container contains the minimum number of filters as specified in Appendix 2.5 of the TRAMPAC. The model number of each filter or combination of filters installed in a payload container is recorded and stored in the WTS and reported to the WWIS in accordance with MP-TRUW-8.16, *WWIS Data Transfer*.

3.3 Radiological Properties

With respect to the required radiological properties identified within this section, they can be divided into two distinct groups.

The first group includes the activities and masses of the ten WIPP-tracked radionuclides (i.e., ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs) and the TRU alpha activity concentration (i.e., >100 nCi/g of alpha-emitting TRU isotopes with half lives greater than 20 years) of the waste. This set of radiological properties is regulated by the EPA in accordance with 40 CFR Parts 191 and 194 (references 32 and 33). Estimates of their activities and masses shall be derived from a system of controls certified by CBFO that includes AK, computations, measurements, sampling, etc. (reference 8, appendix WCL). Appendix A provides the methods and requirements by which to characterize the radiological composition of the CH-TRU waste utilizing radioassay techniques.

The second group includes the remaining radionuclides contributing to the fissile gram equivalent (FGE), the plutonium-239 equivalent curies (PE-Ci), and the decay heat of the payload container. This set of radiological data is regulated both by the NRC as specified in the TRAMPAC (reference 45) and the CBFO as required by the WIPP Technical Safety Requirements (reference 15). PE-Ci quantities shall be calculated for each payload container in accordance with appendix B. Any TRAMPAC compliant method may be used to quantify the remaining radiological properties at the discretion of the shipping facility. Appendix A provides recommended radioassay methods by which to characterize the remaining radiological properties. However, the resulting data (e.g., AK from Safeguards and Security data), the source/method from which the data was generated, and the basis for the reliability of the data shall be submitted to and approved by CBFO prior to use.

3.3.1 Radionuclide Composition

Acceptance Criterion. The activities and masses of ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs shall be established on a payload container basis for purposes of tracking their contributions to the total WIPP radionuclide inventory (reference 8, appendix WCL). The estimated activities and masses, including their associated total measurement uncertainties (TMU) expressed in terms of one standard deviation, for these ten radionuclides shall be reported to the WWIS on a payload container basis. For any of these ten radionuclides whose presence can be substantiated from AK, direct measurement, computations, or a combination thereof, and whose measured data are determined to be below the lower limit of detection (LLD) for that radionuclide, the site shall report the character string "< LLD" to the WWIS for the activity and mass of that radionuclide; otherwise a value of zero shall be reported. See appendix A, section A.3, for information pertaining to the development and application of LLD.

In addition, all radionuclides other than the ten WIPP-tracked radionuclides (i.e., ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs) that contribute to 95% of the radioactive hazard for the payload container shall be reported on the TRUPACT-II bill of lading or manifest in accordance with 49 CFR §172.203 and 49 CFR §173.433 (reference 35, reference 36). The activities and masses of these other radioisotopes shall also be reported to the WWIS along with their associated TMU, expressed in terms of one standard deviation for each waste container (reference 8).

Compliance: The quantity of radionuclides in each payload container along with the associated TMU values (expressed in terms of one standard deviation) is determined using the nondestructive assay (NDA) method described in appendix A and is performed in accordance with work instruction, INST-OI-14, *Drum Assay Operations*. Each radionuclide quantity and its associated TMU are transferred from the DAS to the WTS. The method used to perform the calculations for the radionuclides and associated TMU values are documented in the Canberra Industries, *Genie 2000 Spectroscopy System Customization Tools,* ICN 9230847F4, *NDA 2000 Technical Reference Manual*, ICN 9231595C, and *Total Measurement Uncertainty for the AMWTP Integrated Waste Assay Systems*, CI-IDA-NDA-0055. For the ten radionuclides (^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{235}U, ^{90}Sr, and ^{137}Cs) whose presence can be substantiated from AK, direct measurement, computations, or a combination thereof, and whose measured data are determined to be below the lower limit of detection (LLD) for that radionuclide, WTS reports the character string "<LLD" to the WWIS for the activity and mass of that radionuclide, otherwise a value of zero is reported.

In addition to the ten WIPP-tracked radionuclides, ^{235}U is also quantified, if present above its LLD, in order to calculate the ^{239}Pu Fissile Gram Equivalent (FGE) for compliance with the TRUPACT-II requirements (see section 3.3.2). All radionuclides other than the ten WIPP-tracked radionuclides that contribute to 95% of the radioactive hazard for each container are also stored in the WTS.

The quantity of each radionuclide comprising 95% of the radioactive hazard whose value is above the LLD and its associated TMU expressed in terms of one standard deviation are reported to the WWIS for each payload container and on the TRUPACT-II bill of lading or manifest for each shipment.

3.3.2 ^{239}Pu Fissile Gram Equivalent

Acceptance Criterion. For each payload container and loaded TRUPACT-II, the sum of ^{239}Pu FGE plus two times its associated TMU, expressed in terms of one standard deviation, shall comply with the limits in table 3.3.2 (reference 15, sections 5.9.11 and 5.9.12; reference 45, section 3.1.1). The values calculated for ^{239}Pu FGE and its associated TMU (expressed in terms of one standard deviation) shall be reported to the WWIS for each payload container.

Table 3.3.2
^{239}Pu FGE Limits

Container Type	^{239}Pu FGE Limit
55-gallon drum (including all pipe overpacks)	$\leq$ 200
SWB	$\leq$ 325
TDOP	$\leq$ 325
TRUPACT-II (containing either 14 55-gallon drums, 2 SWBs, or 1 TDOP)	$\leq$ 325
TRUPACT-II (containing either 14 standard, 14 S100, or 14 S200 pipe overpacks)	$\leq$ 2800

Compliance: The ^{239}Pu FGE quantities in each drum container along with the associated TMU values (expressed in terms of one standard deviation) is calculated for each container using the radionuclide values determined by the DAS described in appendix A and the associated ^{239}Pu FGE values tabulated in the American National Standards Institute/American Nuclear Society (ANSI/ANS) Standard 8.15-1981, "*Nuclear Criticality control of Special Actinide Elements"*. The method that is used to perform the calculations for the ^{239}Pu FGE and its associated TMU is documented in the Canberra Industries, *Genie 2000 Spectroscopy System Customization Tools,* ICN 9230847F4, *NDA 2000 Technical Reference Manual*, ICN 9231595C, and *Total Measurement Uncertainty for the AMWTP Integrated Waste Assay Systems*, CI-IDA-NDA-0055. The calculated ^{239}Pu along with its associated TMU are transferred from the DAS in accordance with work instruction INST-OI-14, *Drum Assay Operations*, and is stored in the WTS. The WTS evaluates each payload container and loaded TRUPACT-II for compliance with the limits in table 3.3.2. The values calculated for ^{239}Pu FGE and its associated TMU (expressed in terms of one standard deviation) are reported to the WWIS for each payload container in accordance with management procedure, MP-TRUW-8.16, *WWIS Data Transfer.*

3.3.3 TRU Alpha Activity Concentration

Acceptance Criterion. TRU waste payload containers shall contain more than 100 nCi/g of alpha-emitting TRU isotopes with half-lives greater than 20 years. Without taking into consideration the TMU, the TRU alpha activity concentration for a payload container is determined by dividing the TRU alpha activity of the waste by the weight of the waste. The weight of the waste is the weight of the material placed into the payload container (i.e., the net weight of the container). The weight of the waste is typically determined by subtracting the tare weight of the payload container (including the weight of the rigid liner and any shielding external from the waste, if applicable) from the gross weight of the payload container. In the event waste containers (e.g., 55-gallon drums) that have been radioassayed are overpacked in a payload container (e.g., in an SWB), sites shall sum the individual TRU alpha activity values of the individual waste containers and divide by the sum of the individual net waste weights (i.e., less container, shielding, and liner weights as appropriate) to determine the activity per gram for the payload container. Loading a 55-gallon pipe-overpack with cans is considered direct loading - not overpacking for the purposes of calculating the weight of the container. The TRU alpha activity concentration shall be reported to the WWIS; however, there are no reporting requirements for its associated TMU. (reference 21, section 2[18]; reference 8, chapter 4)

Compliance. The TRU alpha activity in each drum is determined from the alpha-emitting TRU isotopes with half-lives greater than 20 years. The TRU alpha activity is determined using the DAS in accordance with work instruction, INST-OI-14, *Drum Assay Operations*. The TRU alpha activity concentration for each payload container is calculated by dividing the TRU alpha activity by the net weight of the container (weight of the waste). The net weight of the container is determined by subtracting the tare weight of the container (including the weight of the rigid liner and any shielding external to the waste, if applicable) from the gross weight of the container. The method used to determine the gross weight of the container is described in section 3.2.2. The TRU alpha activity concentration is transferred from the DAS and stored on the WTS. In the event a waste drum is overpacked in a payload container, the reported TRU alpha activity concentration for the overpacked payload container is determined by summing the TRU alpha activity values of the individual waste containers and dividing by sum of the net waste weights of the individual waste containers.

The WTS software evaluates each payload container for compliance with the TRU alpha activity concentration limit (>100nCi/g). The TRU alpha activity concentration and the associated TMU is reported to the WWIS for payload containers in accordance with management procedure, MP-TRUW-8.16, *WWIS Data Transfer*.

3.3.4 ^{239}Pu Equivalent Activity

Acceptance Criterion. Plutonium-239 equivalent curie (PE-Ci) limits are shown in table 3.3.4. PE-Ci quantities shall be calculated for each payload container (see Appendix B) and reported to WIPP using the WWIS. There are no reporting requirements for the associated TMU. (reference 15, section 5.9.12)

Table 3.3.4
PE-Ci Limits

Waste Container	Packing Configuration	^{239}Pu PE-Ci Limit
55-gallon drum in good condition	Direct load – all approved waste forms	≤ 80
	Direct load – solidified/vitrified waste only	≤ 1,800
	Overpacked into a 85-gallon drum, SWB, or TDOP – all approved waste forms	≤ 1,100
	Overpacked into a 85-gallon drum, SWB, or TDOP – solidified/vitrified waste only	≤ 1,800
55-gallon drum in damaged condition	Overpacked into a 85-gallon drum, SWB, or TDOP – all approved waste forms	≤ 80, 130, 130 respectively
	Overpacked into a 85-gallon drum, SWB, or TDOP – solidified/vitrified waste only	≤ 1,800
55-gallon pipe component in good condition	Direct load – all approved waste forms	≤ 1,800
85-gallon drum in good condition	Overpacked into a TDOP – all approved waste forms	≤ 1,100
	Overpacked into a TDOP – solidified/vitrified waste only	≤ 1,800
85-gallon drum in damaged condition	Overpacked into a TDOP – all approved waste forms	≤ 130
	Overpacked into a TDOP – solidified/vitrified waste only	≤ 1,800
SWB in good condition	Direct load (or a bin) – all approved waste forms	≤ 130
	Direct load (or a bin) – solidified/vitrified waste only	≤ 1,800
	Overpacked into a TDOP – all approved waste forms	≤ 1,100
	Overpacked into a TDOP – solidified/vitrified waste only	≤ 1,800
SWB in damaged condition	Overpacked into a TDOP – all approved waste forms	≤ 130
	Overpacked into a TDOP – solidified/vitrified waste only	≤ 1,800

Compliance: The plutonium equivalent curies (PE-Ci) for each drum are determined using the DAS in accordance with work instruction, INST-OI-14, *Drum Assay Operations*. Appendix B describes the methodology for calculating the PE-Ci value based on the radionuclide values determined by the DAS as described in appendix A. The PE-Ci value for overpack containers is calculated by the WTS based on the combined drum data. PE-Ci values are transferred from the DAS and stored in the WTS.

The WTS software evaluates each payload container for compliance with the PE-Ci limits in table 3.3.4. The PE-Ci value is reported to the WWIS for each payload container in accordance with management procedure, MP-TRUW-8.16, *WWIS Data Transfer*.

3.3.5 Radiation Dose Equivalent Rate

Acceptance Criterion. The external radiation dose equivalent rate of individual payload containers shall be ≤200 mrem/h at the surface. The external radiation dose equivalent rate of the TRUPACT-II shall be ≤200 mrem/h at the surface and ≤10 mrem/h at 2 m. Additional internal payload container shielding, beyond that identified in appendix 2.1 of the TRAMPAC as an integral component of the payload container, shall not be used to meet this criterion. Total dose equivalent rate and the neutron contribution to the total dose equivalent rate shall be reported for each payload container in the WWIS. (reference 15, section 5.9.12; reference 42, module I, section I.D.1; reference 45, section 3.2.1)

Compliance: Each container is survey by a Radiological Technician (RT) and documented per work instructions, INST-OI-20, *TRUPACT-II Operations*, and INST-OI-21, *TRUPACT-II Payload Assembly.* The highest measured combined dose rate at the drum surface is entered in the WWIS in accordance with management procedure, MP-TRUW-8.16, *WWIS Data Transfer*. The TRUPACT-II is also surveyed and the combined dose rate at the surface and 2 m from any side (excluding the top and bottom) is recorded on the shipping documentation and reported in WWIS. Dose rates for beta-gamma and neutron dose are reported separately.

3.3.6 Decay Heat

Acceptance Criterion. The sum of the decay heat for each payload container plus its TMU shall be less than or equal to the limits of the assigned shipping category specified in table 5.5-1 of appendix 5.5 of the TRAMPAC. For those payload containers that exceed the decay heat limit, a determination of compliance with the unified flammable (gas/VOC) concentration limit as specified in the TRAMPAC allows the payload container to be shipped in the TRUPACT-II package under test category (see section 3.5.5). The values calculated for decay heat and its associated TMU (expressed in terms of one standard deviation) shall be reported to the WWIS for each payload container. (reference 45, section 5.2 and appendix 1.2 and 5.5).

Compliance: The decay heat is determined using the DAS in accordance with work instruction, INST-OI-14, *Drum Assay Operations.* The total decay heat from the radioactive decay of the radioisotopes within an individual payload container, and the total decay heat from all payload containers in a TRUPACT-II, is determined by calculations using isotopic inventory information for fissile and nonfissile TRU radionuclides and for any non-TRU radionuclides present in the payload container. The values for total decay and its TMU are determined using the method described in appendix A. The sum of the calculated value of the decay heat and the total measurement uncertainty at one standard deviation is transferred from the DAS and stored in the WTS.

The WTS or WWIS performs an evaluation to determine if the payload container exceeds the analytical decay heat limit derived from the decay heat limit for shipping categories presented in Appendix 5.5 of the TRAMPAC. As defined in Table 5-2 of Section 5.0 of the TRAMPAC, payload containers of Waste Material Type II.1 and Waste Type III that meet the criteria for the application of dose-dependent G values (watt*year>0.012) are assigned a shipping category that uses a dose-dependent G value. This assignment revises the four-digit G value notation used in the numeric shipping category otherwise assigned to the payload container. For containers that exceed the decay heat limit, a determination of compliance with the unified flammable (gas/VOC) concentration limit specified in the TRAMPAC allows the payload container to be shipped under the test category requirements (see section 3.5.5). The decay heat value and the associated TMU is reported to the WWIS per management procedure, MP-TRUW-8.16, *WWIS Data Transfer*.

The evaluation of payload containers and programmed reassignment of shipping category will be evaluated by WWIS.

3.4 Physical Properties

3.4.1 Residual Liquids

Acceptance Criterion. Liquid waste is prohibited at WIPP. Waste shall contain as little residual liquid as is reasonably achievable by pouring, pumping, and/or aspirating. Internal containers shall also contain no more than 1 inch or 2.5 cm in the bottom of the internal containers. The total residual liquid in any payload container shall not exceed 1 percent by volume of that payload container. If visual examination methods are used in lieu of radiography, then the detection of any liquids in non-transparent internal containers will be addressed by using the total volume of the internal container when determining the total volume of liquids within the payload container. (reference 15, section 5.9.12; reference 42, module II, section II.C.3.a; reference 42, attachment B, sections B-1c and B-3c; reference 45, section 2.6.1; reference 8, appendix WCL)

Compliance: Radiography (INST-OI-12, *Real Time Radiography Operations*) and VE (INST-OI-16, *Drum Coring Operations*, and INST-OI-34, *VE Operating Procedures and Data Reporting*) are used to detect the presence of liquids in payload containers. Residual liquid in well-drained bottles, cans or similar rigid containers is restricted to less than 1 in (2.5cm) of liquid per container as estimated during the examination process. When the sum of all liquids exceeds one percent of the payload container volume or liquids have been identified in rigid containers above specified limits, the container is segregated and sent to the AMWTF for future treatment. The WTS stores a description of the location of any liquid detected and an estimate of the volume.

When VE is used in lieu of radiography, the liquids identified will be removed and/or absorbed at the AMWTF. An independent verification (by a second operator) is performed and documented before closing the container.

3.4.2 Sealed Containers

Acceptance Criterion. Payload containers shall be verified to be free of sealed containers greater than 4 liters. (reference 42, attachment B1, section B1-1a)

Compliance: Radiography (INST-OI-12, *Real Time Radiography Operations*) and VE (INST-OI-16, *Drum Coring*, and INST-OI-34, *VE Operating Procedures and Data Reporting*) are used to detect the presence of sealed containers greater than 4L. Radiography is used to nondestructively confirm the absence of prohibited items. Payload containers with sealed containers greater than 4L will be segregated and sent to the AMWTF.

When VE is used in lieu of radiography, the VE operators remove and/or vent sealed containers. An independent verification (by a second operator) is performed and documented before closing the container.

3.5 Chemical Properties

3.5.1 Pyrophoric Materials

Acceptance Criterion. Pyrophoric radioactive materials shall be present only in small residual amounts (<1 percent by weight) in payload containers and shall be generally dispersed in the waste. Radioactive pyrophorics in concentrations ≥ 1 percent by weight and all nonradioactive pyrophorics shall be reacted (or oxidized) and/or otherwise rendered nonreactive prior to placement in the payload container. Nonradionuclide pyrophoric materials are not acceptable at WIPP. (reference 15, section 5.9.12; reference 42, module II, section II.C.3.b; reference 45, section 4.1.1)

Compliance: Nonradionuclide pyrophoric material is subject to the same controls as explosives (e.g., procurement controls and safety assessments). In general, pyrophoric materials are not permitted in TRU process areas. Processes that require the use of pyrophoric materials require a safety analysis that is used to determine the applicable controls. Generator sites administrative, operational and QA procedures dictate the quantity of pyrophoric materials that enter processes, which are limited and controlled. Operating procedures require that pyrophoric materials be rendered chemically safe by processing before being placed in payload containers (e.g., oxidation at high temperature in the presence of oxygen).

No pyrophoric materials or pyrophoric radionuclides exceeding one percent of the waste weight have been identified in any of the AK documentation, content code evaluations, or sampling programs.

3.5.2 Hazardous Waste

Acceptance Criterion. Hazardous wastes not occurring as co-contaminants with TRU wastes (non-mixed hazardous wastes) are not acceptable at WIPP. Each CH-TRU mixed waste container shall be assigned one or more EPA hazardous waste codes as appropriate. Only EPA hazardous waste codes listed as allowable in the Hazardous Waste Facility Permit may be managed at WIPP. Wastes exhibiting the characteristic of ignitability, corrosivity, or reactivity (EPA hazardous waste numbers of D001, D002, or D003) are not acceptable at WIPP. (reference 42, module II, section II.C.3.g) Hazardous waste codes are synonymous with hazardous waste numbers. (reference 42, module II, sections II.C.3.c and II.C.4)

Compliance: AK documentation identifies physical and chemical properties of the waste that is confirmed by radiography (INST-OI-12, *Real Time Radiography Operations*), VE (INST-OI-16, *Drum Coring Operations* and INST-OI-34, *VE Operating Procedure and Data Reporting*), headspace gas sampling (INST-OI-13, *Drum Vent/Headspace Gas Sampling*), and homogeneous waste sampling and analysis (INST-OI-16, *Drum Coring Operations*, Analytical Chemistry Methods Manual (ACMM)-2900, *Determination of Trace Elements by ICP Atomic Emission Spectrometry,* ACMM-7802, *Determination of Mercury by Cold-Vapor Fluorscence Spectrophotometry,* ACMM-8909, *Microwave Assisted Digestion of Homogeneous Solids and Soil/Gravel,* ACMM-9260, *Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS),* ACMM-9270, *Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry,* ACMM-9441, *Determination of Nonhalogenated Volatile Organic Compounds by Gas Chromatography,* and ACMM Method 9500, *Sample Preparation for Semivolatile Organic Compounds and Polychlorinated* Biphenyls) per the AMWTP QAPjP, provides the basis for EPA hazardous waste code assignment. Each Waste Stream Profile Form (WSPF) documents the applicable hazardous waste codes for each payload container in that waste stream. EPA hazardous waste codes are reported in the WWIS in accordance with management procedure, MP-TRUW-8.16, *WWIS Data Transfer.*

3.5.3 Chemical Compatibility

Acceptance Criterion. TRU waste containing incompatible materials or materials incompatible with payload container and packaging materials, shipping container materials, other wastes, repository backfill, or seal and panel closure materials are not acceptable for transport in the TRUPACT-II and disposal at the WIPP. Chemical constituents shall conform to the lists of allowable materials in tables 4-1 through 4-8 of the TRAMPAC. Other chemicals or materials not identified in these tables are allowed provided that they meet the requirements for trace constituents as specified in section 4.3 of the TRAMPAC. (reference 42, module II, section II.C.3.d; reference 45, sections 4.3 and 4.4)

Compliance: Chemical compatibility studies of the waste and the packaging ensure that the chemical processes do not threaten the safe transport of the TRUPACT-II. Only waste listed in the *TRUPACT-II Content Codes (TRUCON),* DOE/WIPP 89-004, will be shipped in the TRUPACT-II. Potential chemical incompatibilities were evaluated by the NRC for each content code, between one content code and another and between each content code and the TRUPACT-II inner containment vessel (ICV) and the o-ring seals. Waste generated by new processes, or an existing process that has changed, will be evaluated by the WIPP TRUPACT-II Cognizant Engineer to ensure that compliance with the transportation requirements of the TRAMPAC can be demonstrated. New or revised TRUCON codes will not be shipped without written notification indicating approval by the WIPP TRUPACT-II Cognizant Engineer. Waste compatibilities with backfill, seal, and panel closure materials are verified through the use of approved TRUCON codes.

All payload containers selected for shipment to WIPP are evaluated in accordance with management procedure , MP-TRUW-8.5, *TRU Waste Certification,* and the e-TRAMPAC software to ensure that waste that is shipped belongs to an approved TRUCON Content Code.

3.5.4 Explosives, Corrosives, and Compressed Gases

Acceptance Criterion. Waste shall contain no explosives, corrosives, or compressed gases (pressurized containers). (reference 15, section 5.9.12; reference 42, module II, section II.C.3.g; reference 45, section 4.2.1)

Compliance: Most generator sites did not allow explosives in the same facility as TRU waste. Waste generating processes were assessed for safety hazards such as potential explosive hazards and potential inadvertent production of explosive materials. Corrosive liquids were neutralized or absorbed by the generator sites before being shipped to the INEEL. Content code assessments have been performed to ensure liquids have been adequately neutralized.

AK documentation identifies physical and chemical properties of the waste that is confirmed by radiography (INST-OI-12, *Real Time Radiography Operations)*, VE (INST-OI-16, *Drum Coring Operations,* and INST-OI-34, *VE Operating Procedure and Data Reporting)*,(for liquids, pressurized containers, and compressed gases), and continuing intrusive characterization per the AMWTP QAPjP confirm the absence of corrosives and explosives.

Payload containers that are suspected to contain explosives or compressed gases will be segregated and sent to the AMWTF for corrective action.

3.5.5 Headspace Gas Concentrations

Acceptance Criterion. The headspace gas of payload containers shall be sampled and analyzed in accordance with an approved site-specific QAPjP, as defined in the WIPP WAP, to determine volatile organic compound (VOC) concentrations. (reference 42, module II, section II.C.3.I)

Flammable VOCs are restricted to ≤500 ppm in the payload container headspace. For those payload containers that exceed the flammable VOC limit, a determination of compliance with the unified flammable (gas/VOC) concentration limit as described in the TRAMPAC allows the payload container to be shipped in the TRUPACT-II under a test category. (reference 45, section 5.2 and appendix 5.7) Test category payload containers shall be tested to quantify the hydrogen/methane, VOC, and total gas generation rates (as appropriate) for purposes of determining if all applicable limits are met. (reference 45, section 5.2, appendix 1.2 and 5.7)

Compliance: All payload containers selected for shipment to WIPP will undergo headspace gas sampling in accordance with work instruction, INST-OI-13, *Drum Vent/Headspace Gas Sampling,* to determine volatile organic compound (VOC) concentrations and demonstrate the total flammable VOC concentrations are ≤ 500 ppm.

When payload containers exceed the analytical decay heat limit and the concentration of flammable VOCs exceeds 500 ppm, the container belongs to the test category. Full drum testing in accordance with work instruction, INST-OI-18, *Gas Generation Testing Operations*, and/or e-TRAMPAC evaluation is performed to verify that all applicable limits are met.

3.5.6 Polychlorinated Biphenyl Concentration

Acceptance Criterion. Waste shall contain no polychlorinated biphenyl (PCB) concentrations equal to or greater than 50 parts per million (ppm). (reference 42, module II, section II.C.3.f)

Compliance: AK documentation verified by homogeneous waste sampling and analysis (for organic sludge forms suspected of containing PCBs) in accordance with work instruction, INST-OI-16,*Drum Coring* , ACMM Method 9080, *Determination of Polychorinated Biphenyls by Gas Chromatography,* and ACMM Method 9500, *Sample Preparation for Semivolatile Organic Compounds and Polychorinated Biphenyls,* are used to confirm that payload containers contain less than 50 ppm PCBs.

Radiography (INST-OI-12, *Real Time Radiography Operations*) or VE (INST-OI-16, *Drum Coring Operations* or INST-OI-34, *VE Operating Procedure and Data Reporting*) is used to confirm the absence of prohibited waste items. If there is any reason to suspect that an item (i.e., ballasts, transformers) may contain PCBs, the item will be identified as such and the payload container segregated and sent to AMWTF until the correct disposition can be ascertained.

3.6 Data Package Contents

3.6.1 Characterization and Certification Data

Acceptance Criterion. Sites shall prepare a WSPF for each waste stream. Each WSPF shall be approved by the CBFO prior to the first shipment of that waste stream. Characterization and certification information for each payload container shall be submitted to the WWIS and approved by the Data Administrator. Sites are required to estimate the CPR weights and report these estimates in the WWIS on a payload container basis. Any payload container from a waste stream that has not been preceded by an appropriate certified WSPF is not acceptable at WIPP. (reference 42, attachment B, section B-4b[2])

Compliance: The SPM or designated alternate prepares and approves the WSPF and Data Summary Reports in accordance with management procedure, MP-TRUW-8.14, *Preparation of Waste Stream Profile Forms*. A hard copy of the WSPF and Data Summary Report are then transmitted to WIPP for approval. This transmittal is coordinated with the initial characterization data transfer to the WWIS in accordance with management procedure, MP-TRUW-8.16, *WWIS Data Transfer*, for the Data Administrator review and approval. Payload containers from a waste stream that does not have an approved WSPF, will not be certified and shipped.

3.6.2 Shipping Data

Acceptance Criterion. Sites shall prepare either a bill of lading or a uniform hazardous waste manifest for CH-TRU waste shipments as required by the transportation requirements. The land disposal restriction notification for CH-TRU mixed waste shipments shall state that the waste is not prohibited from land disposal. For shipment in TRUPACT-II, the following documents shall be prepared for containers and assemblies, as appropriate: payload container transportation certification document (PCTCD); overpack payload container transportation certification document (OPCTCD); and payload assembly transportation certification document (PATCD). (reference 42, attachment B, section B-4b(2); reference 45, section 6, appendices 6.1 and 6.2)

Compliance: The Transportation Certification Official (TCO) will review and sign, as appropriate, the PCTCD, OPCTCD, and PATCD generated by the WTS or WWIS. The TCO verifies that all requirements for the transportation parameters have been met and completion of the signature authorizes payload containers for shipment in the TRUPACT-II in accordance with management procedure, MP-TRUW-8.5, *TRU Waste Certification*.

The AMWTP will coordinate the preparation of either a bill of lading or a uniform hazardous waste manifest for each CH-TRU waste shipment in accordance with management procedure, MP-TRUW-8.12, *Waste Receipt and Shipping Inspection*. The land disposal restriction notification for CH-TRU mixed waste shipments that the waste is prohibited from land disposal.

4.0 QUALITY ASSURANCE REQUIREMENTS

Quality assurance is an integral part of TRU waste characterization, certification, transportation, and operation activities. This section defines the QA program requirements that assure TRU waste characterization, certification, and transportation activities are performed satisfactorily. The QA requirements applicable to WIPP are addressed in the QAPD (reference 7).

The AMWTP is responsible for developing, documenting, and implementing a site-specific QA plan that address the elements of the QAPD that govern TRU waste characterization, certification, and transportation activities. This section defines the QA program requirements for TRU waste characterization, certification, and transportation activities performed by the AMWTP. This *Certification Plan* will be submitted to the CBFO for approval before TRU wastes are characterized, certified, or shipped to WIPP. The CBFO and AMWTP will conduct audits and surveillances to ensure compliance with this plan. When the QAPD is revised, AMWTP QA plan, procedures, and activities will be evaluated for changes to requirements, and revisions will be initiated and implemented, as appropriate.

4.1 Waste Characterization QA Requirements

The *Quality Assurance Project Plan (QAPjP), MP-TRUW-8.2*, documents the QA and quality control (QC) activities applicable to TRU characterization. Analytical laboratories analyzing WIPP waste characterization samples for the AMWTP have established, documented QA/QC programs.

Data quality objectives are qualitative and quantitative statements that specify WIPP program technical and quality objectives; they are determined through the data quality objective process (reference 25). The data quality objectives for waste characterization activities relating to physical and chemical properties of the waste are contained in the WAP of the *WIPP Hazardous Waste Facility Permit* (reference 42, attachment B3). The radioassay data quality objectives are given in appendix A of this document.

Payload containers with unresolved discrepancies associated with hazardous waste characterization will not be managed or disposed of at WIPP until discrepancies are resolved (reference 42, attachment B4, section B4-4). Corrective action reports applicable to WIPP WAP requirements shall be resolved prior to waste shipment (reference 42, attachment B6, section B6-4).

4.2 Waste Certification QA Requirements

The *Certification Plan for INEEL Contact-Handled Transuranic Waste, MP-TRUW-8.1*, describes the QA and QC activities applicable to certification of TRU waste to the CH-WAC that comply with the requirements of the QAPD (reference 7).

The *TRU Waste Program Procedures Matrix for the DOE-CBFO-QAPD,* MP TRUW-04-IM, identifies applicable documents for each organization or project that implement each applicable requirement of the QAPD. The matrix pertains to all AMWTP waste characterization, certification, and transportation activities. This matrix will be updated as implementation procedures are revised.

4.3 Waste Transportation QA Requirements

Quality assurance requirements for the transportation of TRU waste involve two elements: compliance with TRUPACT-II payload control requirements and compliance with TRUPACT-II usage requirements. The QA requirements for payload control compliance derived from the certificate of compliance for the TRUPACT-II issued by the NRC (reference 43). The certificate of compliance references the TRAMPAC (reference 45). The QA requirements for compliance with TRUPACT-II usage requirements are derived from 10 CFR Part 71, 49 CFR, Part 173 (references 28 and 36), the TRUPACT-II certificate of compliance (reference 43), DOE Orders 460.1 and 460.2 (references 5 and 6), and the CH Packaging Program Guidance (reference 17).

The *TRUPACT-II Authorized Methods for Payload Control (TRAMPAC),* MP-TRUW-8.3, describes the QA and QC activities applicable to the specific parameters of the transportation packaging methods for payload control and the *Certification Plan for INEEL Contact-Handled Transuranic Waste,* MP-TRUW-8.1, describes the QA and QC activities applicable to the usage of the TRUPACT-II. These documents control the used of the NRC-certified packaging (TRUPACT-II) and comply with the CH Packaging Program Guidance (reference 17).

4.4 Quality Assurance Program

The AMWTP Quality Assurance Program (QAP) is based on the QAPD (reference 7) elements outlined below. Table 4.0.1 provides a cross-reference of identical or related QA requirement elements from 10 CFR 830 Subpart A (reference 30) and 10 CFR 71 (reference 29).

- **Organization and QA Program** (QAP) documents the organizational structure, primary interfaces, functional responsibilities, levels of authority, and lines of communication for activities affecting quality, and identifies the activities and items to which the QA program applies.
- **Personnel Qualification and Training** identifies the AMWTP qualification and training programs and plans established to ensure personnel are provided training to perform their assignments and maintain job proficiency.
- **Quality Improvement** describes the processes to detect and prevent conditions adverse to quality, pursue continuous quality improvement, and control and correct nonconforming items.
- **Documents and Records** describes the processes for preparation, review, approval, issue, use, revision, and control of the AMWTP documents and records.
- **Work Processes** identifies the processes by which work conditions, equipment, and special processes are controlled to ensure quality.
- **Procurement** identifies the technical and QA requirements for procured items and services.
- **Inspection and Testing** identifies the processes for inspection and testing.

- **Assessment Requirements** describes the requirements for conducting management and independent assessments to measure management effectiveness, item quality, and process effectiveness and to promote improvement.
- **Sample Control Requirements** identifies the requirements for the control of waste samples, including identification, handling, storing, shipping, and archiving.
- **Scientific Investigation Requirements** describes the requirements for defining, controlling, verifying, and documenting scientific investigations.
- **Software Requirements** specifies the requirements for developing, procuring, maintaining, and using software.

Table 4.0.1. Quality assurance requirements cross-reference table.

QAPD and Certification Plan Section	Equivalent Section in 10 CFR 830.Subpart A, Nuclear Safety Management	Equivalent Section in 10 CFR Part 71, Subpart H, Quality Assurance
Organization and QA Program	Program	QA Organization QA Program
Personnel Qualification and Training	Personnel Training and Qualification	QA Program
Quality Improvement	Quality Improvement	Corrective Action Nonconforming Materials, Parts, or Components
Documents Records	Documents and Records	Document Control QA Records
Work Processes	Work Processes	Instructions, Procedures, and Drawings Identification and Control of Materials, Parts, and Components Control of Special Processes
Procurement	Procurement	Procurement Document Control Control of Purchased Material, Equipment, and Services
Inspection and Testing	Work Process and Acceptance Testing	Internal Inspection Test Control Control of Measuring and Test Equipment

QAPD and Certification Plan Section	Equivalent Section in 10 CFR 830.Subpart A, Nuclear Safety Management	Equivalent Section in 10 CFR Part 71, Subpart H, Quality Assurance
		Inspection, Test, and Operating Status Handling, Storage, and Shipping
Assessment Requirements	Management Assessment Independent Assessment	Audits
Sample Control Requirements	Work Processes	Not applicable
Scientific Investigation Requirements	Not applicable	Not applicable
Software Requirements	Not applicable	Not applicable

4.4.1 AMWTP TRU Program Organization

The TRU Program organization is part of the overall AMWTP organization as defined in MP-ADMN-1.19, *AMWTP Organization Charts*. This section describes the principal organizations involved, the project level positions, and their primary responsibilities. Data generation organizations also support the AMWTP. The central organizational structure is depicted in Figure 4.1.

AMWTP General Manager has overall responsibility for all aspects of the AMTWP, which includes permitting, designs to construction, commissioning, operations, waste certification, packaging, and transportation.

AMWTP Operations Manager is responsible for the safe, efficient production of acceptable waste packaged for disposal at WIPP. Provides commissioning and operations planning and strategies. Ensures planning and execution of the WIPP certification program. Reports to the AMWTP General Manager.

TRU Waste Program Manager is responsible for the planning, execution, implementation, and coordination of activities associated with the characterization, certification, packaging and transportation of waste for disposal in the WIPP, and ensures compliance with applicable requirements. Reports to the Operations Manager.

BNFL Inc. Corporate Quality Assurance Manager, is responsible for providing qualified quality professionals to the AMWTP. The Corporate QA Manager provides professional training and, where applicable, certified individuals to perform QA-related activities.

AMWTP Quality Assurance Manager. ensures development of the QA program and provides QA oversight of work performed by BNFL Inc. and subcontractors in accordance with the plan requirements. Reports to the General Manager and independently to the BNFL Inc. Corporate QA Manager.

Site Project Manager (SPM) has overall responsibility for ensuring that CH-TRU is successfully characterized in accordance with the WIPP-WAP. The SPM (or designated alternates) responsibilities include:

- Ensuring that adequate technical and QA training is provided for personnel performing activities subject to the DOE/CBFO QAPD.
- Reviewing and recommending approval of the QAPjP and subsequent revisions before it is submitted to CBFO for approval
- Waste selection and tracking
- Data validation/verification
- Data reconciliation with data quality objectives (DQOs)
- Assignment of EPA Hazardous Waste Numbers
- Preparing of the Waste Stream Characterization Package
- QA/QC reports to the CBFO
- Characterization data transmittal to CBFO.

Site Quality Assurance Officer (or designated alternate) reports to the AMWTP QA Manager and is responsible for developing, documenting, and monitoring the implementation of QA documentation specific to the characterization, certification, and transportation activities. These responsibilities include, but are not limited to:

- Reviewing the AMWTP QAPjP and subsequent revisions
- Day to day guidance to the project staff on quality-related matters
- Scheduling and conducting QA assessments
- Nonconformance tracking and corrective action verification
- Data validation/verification
- Data QA documentation verification
- Tracking and performing trend analysis of quality problems, and reporting quality problem areas
- Preparing QA/QC reports to Site Project Manager.

- Maintaining liaison with participant QA organizations and other affected organizations
- Ensuring preparation, review, and issuance of QA plans and procedures that implement the provisions of the DOE/CAO QAPD

The SQAO has the authority, access to work, and organizational freedom to identify quality problems, make recommendations for resolution, and verify implementation of corrective actions. In addition, the SQAO will ensure that unsatisfactory conditions are controlled until proper corrective actions have been completed.

To ensure the independence of this QA function, the SQAO is deployed from the AMWTP QA Manager with established lines of communication to the SPM.

Waste Certification Official (WCO), or designated alternate, is responsible for documenting and certifying that all TRU waste payload containers prepared for shipment to the WIPP meet all WAC, and for transmitting the waste certification data to the WIPP. The WCO is responsible for final compilation and approval of CH-TRU Waste Certification Statements. The same or different individuals may perform the functions of the WCO and the TCO.

Transportation Certification Official (or designated alternate), is responsible for documenting and certifying the compliance of payload containers and assemblies with transportation requirements. The TCO approves by signature the transportation certification documents for every payload selected for transport. The same or different individuals may perform the functions of the WCO and the TCO.

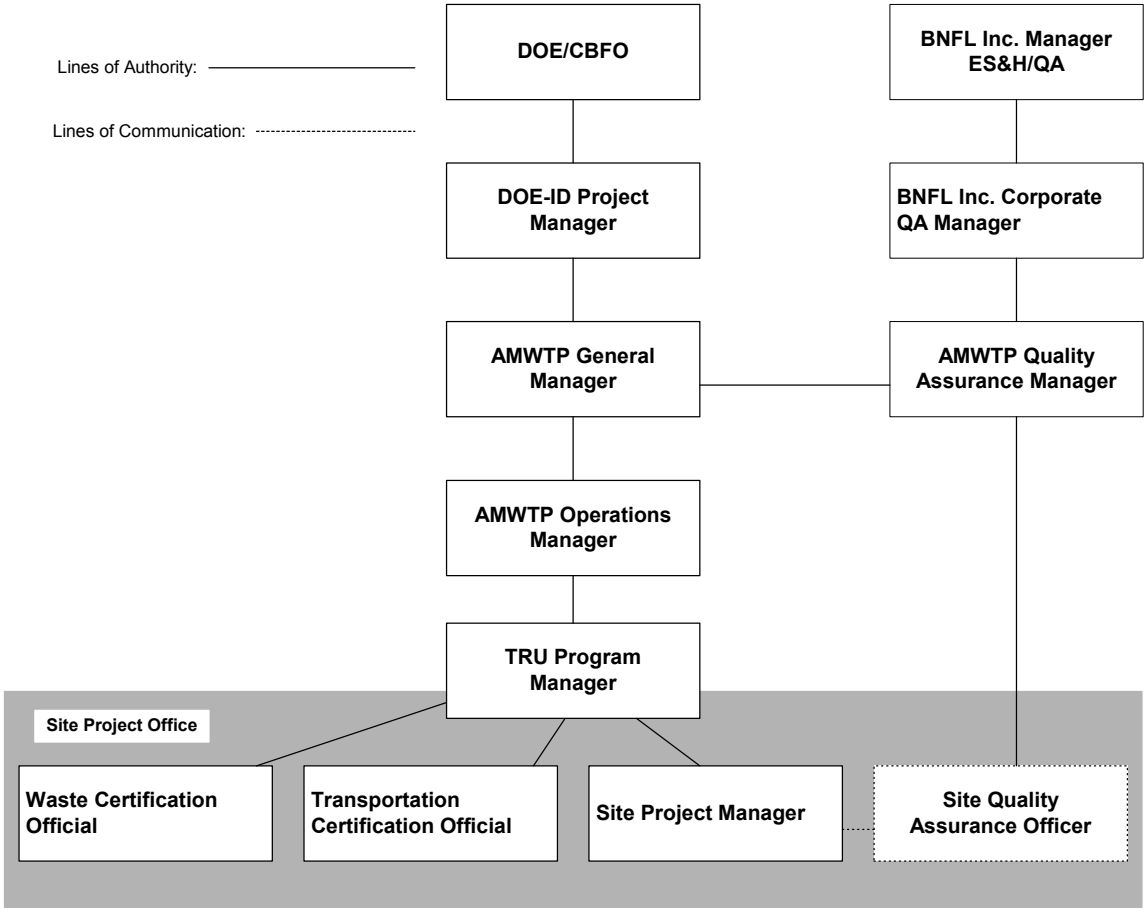

Figure: 4.1 AMWTP TRU Program Organization Structure

4.4.2 AMWTP QA Program Description

This QAP applies to items and activities affecting AMWTP quality. QA activities are integrated into the AMWTP through reviews, assessments, inspections, and approval and control of records and documents. The AMWTP has identified the SPM, SQAO, WCO, and TCO as being responsible for ensuring QA within the AMWTP TRU Program. All personnel involved with TRU waste characterization, certification, packaging, and transportation ensure the quality of their activities and products. If work is delegated, the individual making the delegation retains responsibility for the delegated work. The SQAO and the cognizant AMWTP personnel will resolve disputes related to QAP requirements.

AMWTP TRU Program personnel plan certification activities and document this process. Planning documentation is subject to review by TRU Program management and subject matter experts (SMEs). Project planning documentation consists of the documents discussed in this section, implementing procedures, and training plans. These documents establish performance criteria and methods to measure performance relevant to the AMWTP. All Site Project Office (SPO) personnel are accountable for ensuring quality within their assigned areas of responsibility; however, the SQAO is responsible for determining the effectiveness of this QAP, which is accomplished through internal reporting procedures, assessments, and surveillance's performed in accordance with MP-M&IA-17.1, *Management Assessments*, MP-M&IA-17.2, *Independent Assessments*, and MP-M&IA-17.3, *Surveillances,* respectively.

AMWTP management at all levels has established communication channels that provide timely and wide dissemination of information related to performance, which includes:

- QA program status
- Lessons learned
- Quality improvement
- Results of trend analysis

4.4.3 Implementation of the CBFO QA Program

The provisions of the AMWTP QAP are implemented through the use of numerous program documents and procedures. The relationships between the various external requirements sources and AMWTP programmatic and implementing documents are depicted in Figure 4.2, AMWTP document hierarchy. Implementing procedures are listed within sub-tier program plans, matrices, or other documents. Documents, which collectively define these activities, are presented below:

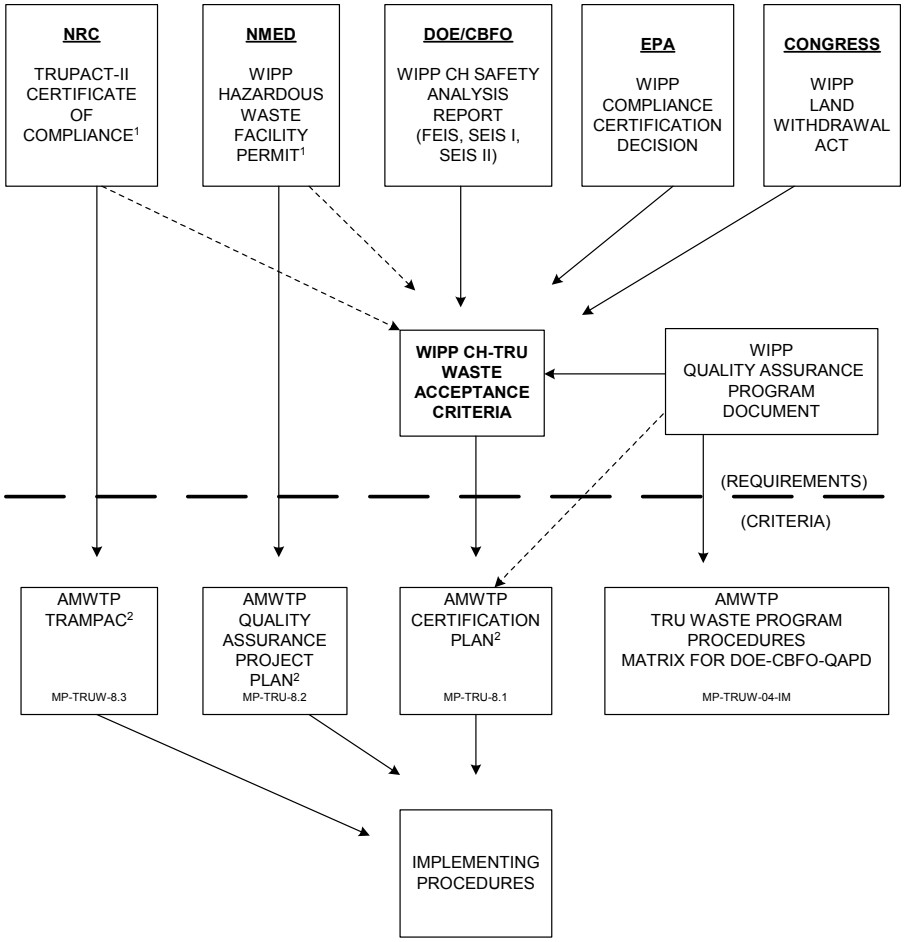

Figure 4.2 AMWTP TRU Program document hierarchy.

4.4.4 Graded Approach

Implementation of the AMWTP QAP is based on the application of the graded approach. The levels of analysis, documentation, verification, and other controls are applied commensurate with an item's risk and importance. The AMWTP graded approach process is implemented in accordance with, *Graded Approach,* MP-Q&SI-5.6. The AMWTP QA Manager is responsible for review and concurrence with quality level designations for the AMWTP Systems, Structures, and Components. MP-Q&SI-5.6, *Graded Approach,* is submitted to the CBFO QA Manager for approval for use in the AMWTP.

4.5 Personnel Qualification And Training

Personnel performing AMWTP TRU Program activities affecting quality receive QA indoctrination and are qualified and trained to ensure that suitable proficiency is achieved and maintained in the performance of their assigned tasks

4.5.1 Qualification

The appropriate managers, with support of the training organization, determine job positions and qualification standards for each job category relevant to the AMWTP. Task responsibilities for personnel are analyzed to ensure education, experience, and training prerequisites is commensurate with minimum requirements specified in accordance with *Job and Training Needs Analysis,* MP-RTQP-14.6

4.5.2 Training

The appropriate managers ensure that all applicable AMWTP personnel receive indoctrination and training on the scope, purpose, and objectives of the TRU Program and the specific Quality Assurance Objectives (QAOs) of the tasks being performed. Personnel performing activities affecting quality are trained according to their respective training plans to ensure they achieve and maintain proficiency prior to performing any tasks subject to these QAP requirements. Personnel receive initial and continuing training requisite with their activities and level of responsibility in accordance with MP-RTQP-14.4, *Personnel Qualification and Certification,* and MP-RTQP-14.20, *Training Implementation Matrix*.

Training is designed, developed, conducted, and evaluated in accordance with MP-RTQP-14.1, *Preparation and Administration of Individual Training Plans.*. Training programs may include classroom instruction, practical hands-on experience, supervised on-the-job training, self-paced individual study, and written, oral, or practical demonstration of worker competence.

The period of effectiveness for qualification associated with special processes, operations that require special skills, and the requalification criteria are specified or referenced *Personnel Qualification and Certification,* MP-RTQP-14.4 or supporting training program plans.

Nondestructive examination (NDE) and Nondestructive assay (NDA) is considered to be a characterization process, therefore, personnel performing NDE are qualified to a program based on the American Society of Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and personnel performing NDA are qualified to ASTM C1490, Standard Guide for selection, training and qualification of NDA personnel. Personnel performing helium leak testing of the TRUPACT-II are qualified in accordance with ASNT SNT-TC-1A and its applicable supplements.

Training is subject to ongoing review to determine instruction and training program effectiveness and shall be upgraded whenever improvements or enhancements are identified in accordance with *Preparation and Administration of Individual Training Plans,* MP-RTQP-14.1.

Personnel performing TRU Program activities affecting quality receive indoctrination in the following:

- General criteria, this QAP, and applicable codes, regulations, and standards
- Specific criteria, including the QAPjP, Certification Plan, TRAMPAC, and the applicable implementing procedures.

Auditable records documenting the required training and qualifications are maintained as QA records and controlled in accordance with MP-RTQP-14.19, *Training Records Administration.*

4.6 Quality Improvement

AMWTP personnel continually evaluate and improve project activities. Personnel are responsible for identifying nonconforming items and processes that do not meet established requirements are identified, controlled, and corrected in accordance with MP-Q&SI-5.4, *Identification of Nonconforming Conditions* and MP-Q&SI-5.3, *Corrective Action*.

4.6.1 Conditions Adverse To Quality

A condition adverse to quality is an all-inclusive term used in reference to failures, malfunctions, deficiencies, and nonconforming items, materials, parts, components, data, and processes. Significant conditions adverse to quality are those that, if uncorrected, could have a serious effect on safety, operability, waste isolation, TRU waste site certification and shipment, regulatory compliance demonstration, or effective implementation of the QA program.

Conditions adverse to quality are classified according to their significance and the corrective action developed accordingly.

The SQAO ensures that quality in the TRU Program by identifying and reporting conditions adverse to quality, analyzing trends, reporting and tracking nonconformances, and implementing corrective actions in accordance with MP-Q&SI-5.1, *Investigations and Root Cause Analysis*. These quality improvement activities detect and prevent unacceptable quality problems and thereby increasing accuracy and reliability, and reducing variability.

4.6.2 Controlling Conditions Adverse To Quality

Conditions adverse to quality are investigated and documented, including the extent of the condition and the impact on completed work. As appropriate, corrective action plans are developed, documented and implemented as soon as practicable.

The SQAO notifies CBFO of all conditions adverse to quality affecting waste to be shipped to WIPP and forwards all reports upon issuance and again upon closure related to violations of the WAP (reference 42, Attachment B) to CBFO for tracking. All deficiencies are evaluated for Price-Anderson Amendments Act applicability and reporting and require verification of completion of assigned action items prior to closure.

All violations of the WAP must be managed as a significant condition adverse to quality. Significant conditions adverse to quality are reported and evaluated by the AMWTP QA Manager, other relevant regulatory compliance organizations (e.g., environmental and safety), and the responsible management, to determine if a work suspension is necessary. If a work suspension is warranted, the SQAO, the AMWTP QA Manager, or the BNFL Inc. Corporate QA Manager verifies and documents the completion of applicable corrective actions prior to any management action releasing the work suspension. AMWTP work suspensions are processed in accordance with *Identification of Nonconforming Conditions*, MP-Q&SI-5.4.

The CBFO is notified of Corrective Action Reports that relate to violations of the WAP. Corrective Action Plans relating to these violations of the WAP and all DOE/CBFO issued Corrective Action Reports (CARs) address corrective action planning and follow-up for significant conditions adverse to quality. Instructions governing these activities are detailed in procedures referenced in *Identification of Nonconforming Conditions*, MP-Q&SI-5.4.

4.6.3 Nonconforming Items

Management at all levels fosters a "no-fault" attitude to encourage the identification of nonconforming items and processes. Nonconformances are uncontrolled and unapproved deviations from an approved plan or procedure. Nonconforming items are those that do not meet the AMWTP requirements, procurement document criteria, or approved work procedures. All AMWTP personnel are responsible for promptly reporting any nonconformance condition identified as adverse to quality to management.

The AMWTP identifies and documents nonconformances. The nonconformance process is controlled in accordance with *Identification of Nonconforming Conditions*, MP-Q&SI-5.4. This procedure describes AMWTP-specific nonconformance procedures and communication with WIPP concerning nonconformance tracking and resolution. It also describes the methods to identify, control, and dispose of nonconforming items (nonconforming items are identified by marking, tagging, or segregating the items).

Identification of Nonconforming Conditions, MP-Q&SI-5.4 is used for nonconformances identified during data generation level and project level data review. AMWTP nonconformance reports (NCRs) are processed electronically and/or tracked in hard copy.

An NCR is prepared for each nonconformance identified, including or referencing, as appropriate, results of laboratory analysis, QC tests, audit reports, internal memoranda, or letters. The NCR provides the following information:

- Identification of the individual(s) identifying or originating the nonconformance
- Description of the nonconformance
- Method(s) or suggestions for correcting the nonconformance (corrective action)
- Schedule for completing the corrective action
- An indication of the potential ramifications and overall usability of the data, if applicable
- Any approval signatures specified in the site nonconformance procedures.

Identification of Nonconforming Conditions, MP-Q&SI-5.4, also assigns responsibilities to AMWTP organizations and personnel to identify, report, control, evaluate the nonconformances, obtain and document a disposition, determine cause, track, and define corrective action for reported nonconforming items. The SQAO (or designated alternate) oversees the AMWTP NCR process. The SPM and SQAO are notified when a nonconformance related to the AMWTP TRU Program is observed or detected. Operations, SPM and SQAO are responsible for evaluating nonconformances and taking appropriate corrective action.

Documentation of nonconformances is made available to the SPM. CBFO receives written notification of all non-administrative nonconformances (that is, a failure to meet a DQO specified by the WAP) or confirmatory analytical techniques specified in the WAP are inconsistent with AK documentation first identified during the SPM review level within five days of identification. These NCRs are also submitted to CBFO within 30 days of identification (reference 42, Attachment B, Section B3-13).

4.6.4 Corrective Action and Planning Follow-up

Corrective actions are planned and prepared for all significant conditions adverse to quality and for any violation of the WAP. The quality systems established for corrective actions and reporting are described in MP-Q&SI-5.3, *Corrective Action*. The AMWTP identifies and implements corrective actions before TRU waste is shipped to WIPP. Corrective Action Reports (CARs) generated by CBFO are tracked in hard copy and processed per CBFO instructions. These corrective actions address considerations including:

- The extent and impact of the significant condition adverse to quality
- Actions to resolve the initial problem
- Root cause of the problem
- Actions to be taken to preclude recurrence
- Responsible personnel, responsibilities, and expected completion dates for the required actions.

A follow-up of completion of proposed corrective actions occurs to verify timeliness and effectiveness of implementation.

4.6.5 Improvement Analysis

Performance data are identified, collected, and routinely analyzed to identify opportunities to improve items, activities, and processes. Analysis of quality performance data serves to identify trends adverse to quality. These analyses shall consider information from external sources and not be limited to one type of work or to one organization. Reports of conditions adverse to quality are evaluated to identify adverse quality trends and identify root causes, with results reported to responsible management and to the applicable quality assurance organization. The SQAO is responsible to generate a TRU Programs trend analysis report semiannually in accordance with MP-Q&SI-5.1, *Investigations and Root Cause Analysis*.

When conditions adverse to quality are identified on a recurring basis, actions are taken to evaluate those conditions in order to minimize their impact and to preclude recurrence. For recurring conditions adverse to quality, management shall, as appropriate:

- Determine the events leading to the occurrences
- Develop an understanding of the technical and work activities associated with the conditions adverse to quality
- Ascertain and identify any generic implications and impacts on completed work
- Determine the extent to which similar quality problems, or precursors to the problem, have been recognized by the responsible organization
- Determine the effectiveness of any corrective actions that were taken
- Consider suspending work associated with the applicable activity
- Suggest actions that can be taken by the responsible organization to preclude recurrence.

4.7 Documents and Records

4.7.1 Document Control

Documents that specify quality requirements or establish activities affecting quality are controlled to ensure that accurate and current documents are used. Document Control personnel ensure that documents are approved, distributed, filed, and maintained in accordance with current procedures.

AMWTP personnel prepare and control documents supporting quality in accordance with management procedure, MP-DOCS-18.4, *Document Control*. Document owners ensure that documents are developed as prescribed by current procedures, reviewed for adequacy, correctness, completeness, and are approved and revised, as needed. Document control personnel verify proper document approval and ensure the documents are distributed to the appropriate personnel.

4.7.2 Document Preparation, Review, Approval and Issuance

Instructions, procedures, and drawings are reviewed for adequacy, correctness, and completeness prior to approval and issuance. MP-DOCS-18.1, *Developing Written Work Instructions*, addresses approved AMWTP policies and procedures for the initiation, preparation, review, and revision control of work instructions and MP-DOCS-18.3, *Developing Management Procedures*, addresses approved AMWTP policies and procedures for the initiation, preparation, review, and revision control of management procedures for all quality-related activities. Non-routine/temporary processes may be addressed by making temporary changes in procedures and plans. CBFO approves quality affecting changes prior to implementation.

Qualified and independent personnel review all quality documents for adequacy, correctness, and completeness prior to approval and issuance. MP-DOCS-18.4, *Document Control*, identifies the individuals and/or organizations responsible for the preparation, review, approval, and issuance of controlled documents.

- Documents are controlled during the review and approval phase, by the document owner, in accordance with approved procedures.
- The requesting organization identifies the applicable criteria for the review. These criteria consider technical adequacy, accuracy, completeness, and compliance with established requirements.
- Pertinent background information or data are made available by the organization requesting the review if the information is not readily available to the reviewer.
- Individuals other than the originator perform this review.
- Reviewers are technically competent in the subject area being reviewed.
- The organization or technical discipline affected by the document reviews the document according to the established review criteria.
- The appropriate quality assurance organization reviews documents that translate CBFO QAPD, or other CBFO requirements.
- Review comment documentation is resolved by the document owner in accordance with approved procedures. Evidence of review comment resolution is maintained by the originating organization.
- Documents are approved for release by authorities designated in accordance with approved procedures.
- Designated individuals or organizations issue documents in accordance with approved procedures.

Changes to WAP related plans and procedures are reviewed and approved by the SPM and the SQAO. All non-administrative changes are reviewed and evaluated to determine whether changes will affect performance criteria or data quality, such as sample handling and custody requirements, sampling and analytical procedures, quality assurance objectives, calibration requirements, or QC sample acceptance criteria. After site certification authority has been obtained, any changes to WIPP-WAP, related plans, or procedures that could positively or negatively impact DQOs (that is, those changes that require prior approval of WIPP as defined in Section B5-2 of the WIPP-WAP) shall be reported to WIPP within five (5) days of identification by the Project Level review. The WIPP shall send NMED a monthly summary briefly describing the changes to plans and procedures identified pursuant to this section during the previous month.

4.7.3 Document Distribution and Use

Distribution and use of controlled documents and forms that document or prescribe work, including changes and editorial corrections to document are described in management procedures, MP-DOCS-18.4, *Document Control* and MP-DOCS-18.8, *AMWTP Forms Management*.

4.7.4 Records

A QA record is an authenticated record that provides evidence of the quality of items and/or activities affecting quality. The AMWTP QA records are controlled and maintained to certify compliance with requirements and to reflect completed work. The QA records are identified, indexed, classified, controlled, maintained, and dispositioned by records management personnel as described in MP-DOCS-18.2, *AMWTP Records Management*.

Records related to waste characterization sampling and analysis are maintained in the testing, sampling, or analytical facility files or at the AMWTP Records Storage Facility. Contract laboratories forward testing, sampling, and analytical QA documentation along with batch data reports, to the AMWTP Records Storage Facility. Raw data obtained by testing, sampling, and analyzing TRU waste in support of this document is identifiable, legible, and provides documentary evidence of quality.

Altris eB®, an electronic records system, [the equivalent of a CBFO required Records Inventory and Disposition Schedule (RIDS)] has been prepared, approved, and implemented by the AMWTP. All records relevant to an enforcement action under the WIPP Permit, regardless of disposition, will be maintained at the AMWTP until NMED determines that the records are no longer needed for enforcement action. The records will then be dispositioned as specified in MP-DOCS-18.2, *AMWTP Records Management.*

4.8 Performance Requirements

The work processes and items supporting and affecting TRU Program quality are controlled through plans and procedures identified in MP-TRUW-04-IM, *AMWTP TRU Waste Program Procedures Matrix for DOE-CBFO-QAPD*. Technical and QA personnel comply with the applicable technical standards and administrative controls described in procedures, which are reviewed and approved by the SPM (or designee), the SQAO (or designee), and cognizant management for use in the TRU Program. Cognizant managers ensure personnel perform work following established procedures. These procedures provide the following information:

- Organizational and individual responsibilities
- Training and qualification requirements
- Technical, regulatory, and QA requirements
- Step-by-step instructions for the process (prepared by an SME of the cognizant organization)
- Equipment specifications
- Methods and criteria for ensuring and verifying the acceptability of equipment and materials used in the process (e.g., calibration)
- Requirements, precautions, process parameters, and other limiting conditions
- Products of the process
- Quantitative and/or qualitative criteria for determining that prescribed process activities have been performed satisfactorily
- Records generated by the process
- Package and design control of equipment and materials.

The SPM and cognizant managers ensure that TRU Program activities are controlled and conducted in accordance with process-specific procedures that describe and control work processes applicable to TRU waste characterization, certification, packaging, or transportation. If equipment is designed for TRU waste characterization, certification, and transportation activities, site personnel comply with QAPD design control. Each individual performing the work is responsible for ensuring that work processes are controlled and comply with established criteria. Facility managers are responsible for ensuring that workers have the correct procedures, materials, and training to perform quality work. All instructions and procedures are maintained current with a documented and controlled method of revision. Instructions, procedures, and drawings are readily available to AMWTP personnel at locations requiring their use.

Fabrication, installation, and inspection processes that have an effect upon the quality of items or services important to safety are controlled by process procedures.

Special processes controlled under this QAP are NDE, NDA, and helium leak testing. These processes are controlled by the procedures referenced in MP-TRUW-04-IM, *AMWTP TRU Waste Program Procedures Matrix for DOE-CBFO-QAPD.*

4.9 Design Control

Design Control is not applicable to the AMWTP TRU Program QA requirements.

4.10 Procurement

The AMWTP ensures that procurement of items and services important to safety and quality meet requirements and perform as intended. Procurement controls are also applicable to equipment and services that directly affect testing, sampling, and analytical data quality. Project personnel adhere to procurement and record-keeping practices established in written procedures.

The procurement criteria are implemented according to the procedures specified in the following subsections.

4.10.1 Procurement Document Control

The AMWTP Operations Manager and AMWTP QA Manager ensure personnel control procurement documents in accordance with MP-PCMT-15.3, *Purchase Order/Subcontract Preparation and Control*. Procurement documents supporting waste management and packaging and transportation control must include required specifications and acceptance criteria. Procurement documents are reviewed by appropriate organizations and engineering disciplines to ensure that they contain adequate scope of work, technical requirements, supplier QA program requirements, and provisions for acceptance.

4.10.2 Control of Purchased Items and Services

The AMWTP Operations Manager and QA Manager ensure that personnel control items and services purchased (including supplier evaluations and inspections) in accordance with MP-PCMT-15.7, *Vendor Qualification and Performance Evaluation*. Documentary evidence that items, material, and equipment conform to the procurement specifications is provided before installation or use of the item, material, and equipment, and is retained in accordance with MP-PCMT-15.3, *Purchase Order/Subcontract Preparation and Control*. Potential suppliers of goods and services will have their own QA program or will comply with applicable AMWTP requirements.

Measures are established to ensure that materials, parts, and components used for repair work for maintenance purposes, or packaging and transportation purposes, are adequately identified to preclude the use of incorrect or defective items. Also, where replacement of limited-life items is specified, measures are established to preclude use of items whose shelf life or time in operation has expired.

4.10.3 Control of Subcontractors

MP-PCMT-15.3, *Purchase Order/Subcontract Preparation and Control*, also applies to subcontractors who perform work that directly affects the quality of characterization and certification data. Subcontractors are required to establish procurement controls and a QA program to ensure that purchased materials, equipment, and services conform to AMWTP procurement and QAP procedures. The controls must include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products on delivery. Subcontractors are subject to periodic assessments and audits at intervals consistent with the importance, complexity, and quantity of the product or services provided, to ensure compliance with procurement requirements.

Subcontractors may support activities under a "staff augmentation" role or for procurement of products and services. The staff augmentation subcontractors operate under the purview of this QAP and are subject to all applicable requirements for the AMWTP-related functions they perform. All subcontractors who support the AMWTP will be informed of the need to perform operations in compliance with QAPD requirements.

4.11 Inspection and Testing

Equipment is tested, inspected, and identified, in accordance with approved procedures**.** AMWTP personnel identify and control items (e.g., items with limited shelf or operating lives, materials, equipment, samples) and ensure that only correct and accepted items are used. This procedure addresses planning, parameters for evaluation, techniques to be used, and qualification of inspection and test personnel, hold points, documentation, acceptance criteria, and organizational responsibilities.

AMWTP personnel routinely test and inspect items and processes and control, calibrate, and maintain equipment to ensure proper operation and data quality. The procedure identified above implements an inspection program that establishes criteria for inspection of activities affecting quality by, or for, the organization performing the activity, and to verify conformance with the requirements for accomplishing the activity. The verification is performed in accordance with written procedures, instructions, or drawings. Personnel performing the inspections are independent from the individuals performing the activity being inspected. Equipment modifications, repairs, and replacement are inspected in accordance with the original design and inspection requirements, unless an approved alternative exists. The inspection program also provides for identification and documentation of deficiencies discovered during the inspection. Identification and documentation of deficiencies are accomplished in accordance with Q&SI-5.4, *Identification of Nonconforming Conditions*. Measures are established to indicate, by the use of markings, tags, stamps, labels, routing cards, or other suitable means, the status of inspections and tests performed. These measures provide for the identification of items that have satisfactorily passed required inspections and tests, where necessary, to preclude inadvertent bypassing of the inspections and tests.

Measuring and test equipment with the necessary range and accuracy is provided to qualified personnel for the inspection, test, and acceptance of material, parts, components, and systems. Equipment accuracy is ensured by periodic calibration that is traceable to national standards or a documented equivalent basis for calibration.

The AMWTP ensures that equipment used for inspection and testing is properly controlled, calibrated, and maintained in accordance with MP-CMNT-10.5, *Calibration of Measuring and Test Equipment Program*.

The test control program is established for items and services important to safety. No testing requiring a test control program relative to waste payload containers or the TRUPACT-II will be performed under this program.

Specific measures to control use, operation, inspection, and maintenance of the TRUPACT-II shipping container and directly related components are established in accordance with requirements in DOE/WIPP 02-3183, *CH Packaging Program Guidance* and DOE/WIPP 02-3184, *CH Packaging Operations Manual*. These procedures address the following requirements:

- Operating and maintenance procedures – Sites may use the specific instructions provided by DOE/WIPP 02-3184, *CH Packaging Operations Manual*, or develop their own procedures using steps from this document word for word, in sequence, including Notes and Cautions. Site-specific procedures must be submitted to WIPP for approval and a copy of the approval letter available for audit purposes.

- Record Maintenance – Records regarding inspections, tests, and maintenance must be retained for a period of three years after the life of the package to which they apply. Original records designated as QA records will be maintained, as permanent records at WIPP and the user preparing the maintenance records will retain a copy for their file.

- Material Control – All components will be procured and furnished to the user sites by WIPP. All components shall be verified as complying with applicable material requirements specified in the TRUPACT-II SAR drawings. Inspection reports, test reports and material certificates of conformance are maintained at WIPP. Spare parts furnished by WIPP will be labeled with a part number, description, WIPP purchase order number, and shelf life expiration date, if applicable.

- Training requirements –Users that perform maintenance, leak testing, component replacement, and related operations receive training as required in DOE/WIPP 02-3183, *CH Packaging Program Guidance*, Attachment C. NDE, NDA, and leak testing are a special process discussed in Section 4.3.1 of this QAP.

- Nonconformance Reports - Conditions encountered during inspections of the TRUPACT-II that are not correctable by using work instructions contained in DOE/WIPP 02-3183, *CH Packaging Program Guidance*, Attachment B, should be brought to the attention of the WIPP CH Packaging Engineer for resolution.

- Prior to shipment of a TRUPACT-II, conditions of the NRC's certificate of compliance shall be satisfied. Required shipping papers shall be prepared and shall accompany the shipment.

4.12 Assessment Requirements

The AMWTP participates in an assessment program to ensure compliance with applicable QA requirements. Management assessments are performed on every level of management. Qualified personnel who are independent from the activities being assessed perform independent assessment and surveillance activities. The CBFO and external regulatory agencies also conduct assessments of the AMWTP. The SQAO tracks deficiencies identified during assessments and the corrective actions to resolve deficiencies according to *Corrective Action*, MP-Q&SI-5.3.

4.12.1 Management Assessments

The AMWTP managers periodically assess the performance of their organization to determine the effectiveness of QAP provisions that enable the organization to comply with requirements of the WIPP-WAP, QAPD, WIPP-WAC, TRAMPAC, and applicable procedures and documents. Managers evaluate the QAP effectiveness by focusing on the identification and resolution of both systemic and management issues and problems, and by identifying strengths and weaknesses to facilitate actions to improve quality, efficiency and cost-effectiveness. The management assessment should include an introspective evaluation to determine whether the entire integrated management system effectively focuses on meeting strategic goals. Management assessments are conducted as described in MP-M&IA-17.1, *Management Assessments*. The SPM is responsible for ensuring that assessments affecting TRU Program characterization, certification, and transportation activities are conducted regularly and reported at least annually on relevant findings.

4.12.2 Independent Assessments

Documented independent assessments are used to measure item service and quality, process adequacy and effectiveness, and to promote improvement. AMWTP personnel and facilities are subject to periodic independent assessments as identified by the SQAO. The SQAO ensures that characterization facilities and analytical laboratories are assessed. Assessment teams include one or more qualified assessors, one of whom must be a certified lead assessor. Assessment personnel qualifications are addressed in the MP-Q&SI-5.8, *Qualification of Inspection, Test, and Audit Personnel.*

For independent assessments performed by the SPO, the assessment team is made up of a team leader appointed by the SQAO and team members and technical specialists selected by the team leader in conjunction with the SQAO. The team leader provides indoctrination and supervision of the team, organizes and directs the assessment, establishes the scope of the assessment, prepares a plan for conducting the assessment, and prepares and issues an assessment report to the management of the assessed organization and any affected organizations. The assessment team members and technical specialists prepare the assessment checklist, conduct the assessment, brief the management of the assessed organization on a daily basis, and prepare a draft report for presentation at the exit conference for the assessment. Independent assessments are performed in accordance with MP-M&IA-17.2, *Independent Assessment*.

The SQAO ensures the acceptable knowledge process and waste stream documentation is evaluated through internal assessments by the AMWTP quality organization and assessments by auditors or observers external to the AMWTP.

4.12.3 Surveillances

The surveillance program is conducted primarily to monitor work in progress and to follow up on corrective actions. Surveillance results are reported and monitored similarly to other assessment activities. Surveillances are performed in accordance with MP-M&IA-17.3.

4.12.4 CBFO Audits

Facilities participating in characterization, certification, and shipment of waste to WIPP are subject to CBFO audits, as discussed in Attachment B6 of the WIPP-WAP (B-4b(1)(iii)). A CBFO audit of the AMWTP is conducted before waste is shipped to WIPP and annually thereafter. These audits are the responsibility of the CBFO QA manager, who coordinates these audits through the SPM and SQAO.

The CBFO is responsible for granting or suspending a site's authority to certify TRU waste and to use the TRUPACT-II based upon an assessment of their documented TRU waste program and its implementation. Subsequent to the initial audit, the CBFO will perform audits at least annually. CBFO may also perform unannounced audits and surveillance's at the AMWTP to confirm continued compliance with the approved plans.

4.12.5 Reports to Management

The SQAO shall summarize all relevant information on the QA/QC activities during the period in a semiannual report. The SQAO reports these independent assessment results to the SPM in accordance with management procedure, MP-TRUW-8.26, *Reports to Management*. The SPM shall review the report; comment if appropriate, and then forward a copy of the report with comments to the DOE Field Office and the AMWTP General Manager. The annual QA report includes the following information, as appropriate:

- Any changes to the AMWTP QAPjP
- Identification of any significant QA/QC problems, recommended solutions, and corrective actions

- An assessment of QC data collected during the period, including the frequency of repeated analyses, reasons they were repeated, and corrective actions
- Discussions of whether QAOs have been met and any resulting impact on decision making
- Limitations on the use of measurement data
- Status of Performance Demonstration Program (PDP) results
- Results of audits and surveillances conducted during the period
- Performance Demonstration Program

The AMWTP and supporting facilities participate in the Headspace Gas Sampling (HGS) and Solids Sampling PDP as summarized in the AMWTP QAPjP. PDP samples are processed according to the facility procedures applicable to the specific testing or analytical characterization activity being assessed. Results are reported to CBFO for evaluation and approval of the system.

The AMWTP also participates in the Non-Destructive Assay (NDA) PDP as summarized in the Appendix A of this document. The AMWTP demonstrates compliance with the QAO for precision and accuracy by performing replicate processing of a mock waste container containing quantities of TRU isotopes for each range for which the measurement system is to be qualified. Results are reported to CBFO for evaluation and approval of the system.

4.13 Sample Control Requirements

AMWTP personnel and supporting contractors follow procedures to ensure proper documentation and tracking of sample possession from the time of collection/identification, through handling, preservation, shipment, transfer, analysis, storage, and final disposition. Sample control procedures used by personnel are described in the AMWTP QAPjP. AMWTP personnel ship samples in compliance with the Department of Transportation (DOT) regulations and Project QA requirements.

4.14 Scientific Investigation Requirements

The AMWTP uses data validation as a systematic process for reviewing radioassay data to ensure that data are of known and documented quality and that the required data quality objectives are met. Results of the review may require that qualifiers be placed on the use of the data.

All radioassay data reviewed and approved by qualified personnel prior to being reported. Personnel performing validation at the AMTWP are trained to the existing industry standardized training requirements (e.g., ASTM C1490, *Standard Guide for Selection, Training and Qualification of Nondestructive Assay [NDA] Personne*l and meets the specifications in the QAPD.

The Technical Reviewer is independent of the collection activities and the results of the review are documented as defined in MP-TRUW-8.8, *Level I Data Validation.* The review ensures the following as applicable:

- Data is recorded so that it is clearly identifiable and traceable to the source of generation.
- Data transferred and reduced from logbooks, data sheets, and radioassay instrumentation are evaluated to determine if the data was collected in a technical correct manner.
- Deviations are documented
- QA results are complete and documented correctly.
- Results are compared to the acceptance criteria to determine if the data is valid.
- Data that are determined to be rejected, superseded, or otherwise unsuited for their intended use are documented in accordance with MP-Q&SI-5.4, Identification of Nonconforming Conditions.
- All data records from logbooks, data sheets, or radioassay instrumentation are maintained in accordance with MP-DOCS-18.2, *AMWTP Records Management*.

4.15 Software Requirements

Computer software used in the manipulation or production of data in the processing, gathering, or generation of information whose output is relied upon to make design, analytical, operational, or compliance related decisions in the performance of waste characterization, waste transportation, or waste acceptance is developed and maintained in a controlled manner. Computer hardware/software configurations used in AMWTP activities are developed, documented, verified, validated, tested, and controlled prior to use in compliance with requirements contained in the QAPD. Instructions governing these activities are detailed in procedures referenced in MP-CD&M-11.2, *Software Quality Assurance.*

5.0 REFERENCES

NOTE: *AMWTP document references are available in the AMWTP TRU Waste Program Procedures Matrix for DOE-CBFO-QAPD, MP-TRUW-04-IM.*

INEEL Documents

1. EDF-RWMC-803, *Chemical Constituents in Transuranic Storage Area (TSA) Waste*, current revision, Idaho National Engineering and Environmental Laboratory.

2. INEL-96/0280, *Acceptable Knowledge Documentation for INEL Stored Transuranic Waste*, Rocky Flats Plant Waste, current revision, Idaho National Engineering and Environmental Laboratory.

DOE Documents

3. DOE Order 0414.1A, *Quality Assurance*, U.S. Department of Energy.

4. DOE Order 435.1, *Implementation Guide, Chapter III.L, Radioactive Waste Management,* U.S. Department of Energy.

5. DOE Order 460.1, *Packaging and Transportation Safety*, Department of Energy.

6. DOE Order 460.2, *Departmental Materials Transportation and Packaging Management*, U.S. Department of Energy.

7. DOE/CBFO-94-1012, *Quality Assurance Program Document*, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico. (http://www.wipp.ws/library/qapd/caoqapd.pdf)

8. DOE/CAO-1996-2184, *Title 40 Code of Federal Regulations (CFR) 191/194 Compliance Certification Application for the Waste Isolation Pilot Plant*, U. S. Department of Energy, Carlsbad, New Mexico. (http://www.wipp.ws/library/cca/cca.htm)

9. DOE/CBFO-97-2273, *WIPP Waste Information System User's Manual For Use by Shippers/Generators,* U.S. Department of Energy, Carlsbad Area Office (DOE/CAO), Carlsbad, New Mexico. (ftp://ftp.wipp.ws/usermanual.pdf)

10. DOE/EIS-0026, *Final Environmental Impact Statement for the Waste Isolation Pilot Plant,* U.S. Department of Energy, 1980.

11. DOE/EIS-0026-FS, *Final Supplemental Environmental Impact Statement for the Waste Isolation Pilot Plant,* U.S. Department of Energy, 1990.

12. DOE/EIS-0026-S-2, *Final Supplemental Environmental Impact Statement for the Waste Isolation Pilot Plant,* U.S. Department of Energy, 1997.

13. DOE/WIPP 89-004, *TRUPACT-II Content Codes* (TRUCON), current revision, U. S. Department of Energy.

14. DOE/WIPP-95-2065, *Waste Isolation Pilot Plant Safety Analysis Report*, U.S. Department of Energy, Carlsbad, New Mexico. (http://www.wipp.ws/library/chsar/chsar.htm)

15. DOE/WIPP-95-2125, *Waste Isolation Pilot Plant Contact Handled (CH) Technical Safety Requirements*, U.S. Department of Energy, Waste Isolation Pilot Plant (DOE/WIPP), Carlsbad, New Mexico. (http://www.wipp.ws/library/chsar/chsar.htm)

16. DOE/WIPP 02-3122, *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, U. S. Department of Energy, Carlsbad Field Office, Waste Isolation Pilot Plant (DOE/WIPP), Carlsbad, New Mexico.

17. DOE/WIPP 02-3183, *CH Packaging Program Guidance,* U. S. Department of Energy, Waste Isolation Pilot Plant (DOE/WIPP), Carlsbad, New Mexico.

18. DOE/WIPP 02-3184, *CH Packaging Operations Manual*, U. S. Department of Energy, Waste Isolation Pilot Plant (DOE/WIPP), Carlsbad, New Mexico.

19. DOE/WIPP-02-3185, CH Packaging Maintenance Manual, U. S. Department of Energy, Waste Isolation Pilot Plan (DOE/WIPP), Carlsbad, New Mexico.

Codes and Standards

20. Public Law 96-164*, 93 Sta.1259. DOE National Security and Military Applications of Nuclear Energy Authorization Act,* 1980, Section 213(a). (http://thomas.loc.gov/cgi-bin/bdquery/z?d096:SN00673:TOM:/bss/d096query.html)

21. Public Law 102-579, 106 Stat. 4777, 1992 (as amended by Public Law 104-201), *Waste Isolation Pilot Plant Land Withdrawal Act*. (http://www.emnrd.state.nm.us/wipp/lwa.htm)

22. 42 U.S.C. 6901 et seq. *Resource Conservation and Recovery Act (RCRA)* of 1988.

23. 42 U.S.C. 2011 et seq. *Atomic Energy Act (AEA)* of 1954. (http://www4.law.cornell.edu/uscode/42/2011.html)

24. 42 U.S.C 10141. Nuclear Waste Policy Act of 1982. (http://www4.law.cornell.edu/uscode/42/10141.html)

25. EPA-QA/G-4, *Guidance for the Data Quality Objectives Process*, U.S. Environmental Protection Agency. Washington, DC, Quality Assurance Management Staff, U.S. Environmental Protection Agency. (http://www.epa.gov/swerust1/cat/epaqag4.pdf)

26. 63 FR 27353, *Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's*

27. *Compliance with the Disposal Regulations: Certification Decision: EPA Final Rule. Federal Register* 63: 27353-27406, May 18, 1998, Radiation Protection Division, Washington, D.C. (http://www.epa.gov/radiation/wipp/docs/frnotice.pdf)

28. Title 10 CFR Part 71. "*Packaging and transportation of radioactive material.*" Code of Federal Regulations (CFR) (http://www.access.gpo.gov/nara/cfr/cfrhtml_00/Title_10/10cfr71_00.html)

29. 10 CFR 71, Subpart H, *Quality Assurance*, Code of Federal Regulations (CFR)

30. 10 CFR 830. Subpart A, *Nuclear Safety Management*, Code of Federal Regulations (CFR).

31. 10 CFR 835, *Occupational Radiation Protection*, Code of Federal Regulations (CFR). (http://www.access.gpo.gov/nara/cfr/waisidx_01/10cfr835_01.html)

32. Title 40 CFR Part 191. "*Environmental Radiation Protection for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes." Code of Federal Regulations,* Washington, D.C., Office of the Federal Register, National Archives and Records Administration. (http://www.access.gpo.gov/nara/cfr/cfrhtml_00/Title_40/40cfr191_00.html)

33. 40 CFR 194, *Criteria for the Certification and Re-certification of the Waste Isolation Pilot Plants Compliance with the 40 CFR Part 191 Disposal Regulations*, Code of Federal Regulations (CFR). (http://www.access.gpo.gov/nara/cfr/cfrhtml_00/Title_40/40cfr194_00.html)

34. 40 CFR 262, *Standards Applicable to Generators of Hazardous Waste,* Code of Federal Regulations (CFR). (http://www.access.gpo.gov/nara/cfr/cfrhtml_00/Title_40/40cfr262_00.html)

35. 49 CFR 172, *Shipping Papers: Additional Description Requirements,* Code of Federal Regulations (CFR). (http://www.access.gpo.gov/nara/cfr/cfrhtml_00/Title_49/49cfr172_00.html)

36. Title 49 CFR Part 173. "*Shippers–General requirements for shipping and packaging*." Code of Federal Regulations, Washington, D.C., Office of the Federal Register, National Archives and Records Administration. (http://www.access.gpo.gov/nara/cfr/cfrhtml_00/Title_49/49cfr173_00.html)

37. 49 CFR 173.433, *Contamination Control,* Code of Federal Regulations (CFR). (http://www.access.gpo.gov/nara/cfr/waisidx_00/49cfr173_00.html)

38. ASME NQA-1 1989, *Nuclear Quality Assurance*, American Society of Mechanical Engineers.

39. ASME NQA-2 1990, *Nuclear Quality Assurance*, American Society of Mechanical Engineers.

40. ANSI/AIM BC1-1995, *Uniform Symbology Specification* – Code 39, American National Standards, Inc.

41. NIST, Handbook 44, 1996, *Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices*, U. S. Department of Commerce, National Bureau of Standards, National Institute of Standards and Technology (NIST).

42. NM4890139088-TSDF, *Waste Isolation Pilot Plant Hazardous Waste Facility Permit*, New Mexico Environment Department, Santa Fe, New Mexico. http://www.wipp.ws/library/rcrapermit/rcrapermit.htm)

Other Documents

43. U.S. Nuclear Regulatory Commission (NRC), *Certificate of Compliance, NRC Docket No 71-9218*, Office of Regulatory Procedures, Washington D.C. (http://www.wipp.ws/library/t2sar/rev19a/cofc/trucert.pdf)

44. U. S. Nuclear Regulatory Commission (NRC), *Safety Analysis Report for the TRUPACT-II Shipping Package, NRC Docket No 71-9218* (TRUPACT-II SARP), Office of Regulatory Procedures, Washington D.C.

45. U.S. Nuclear Regulatory Commission. *TRUPACT-II Authorized Methods for Payload Control (TRAMPAC)*. Washington, D.C., Office of Regulatory Procedures, U.S. Nuclear Regulatory Commission. (http://http://www.wipp.carlsbad.nm.us/library/t2sar/rev19a/Trampac/TRAMPAC.PDF)

APPENDIX A

Radioassay Requirements for Contact-Handled Transuranic Waste

A.1 Introduction

To support the radiological characterization data required by WIPP, the AMWTP performs nondestructive assay (NDA) on each payload container and reports the following information to WIPP using the WWIS:

- Track the WIPP radionuclide inventory, by isotopic activity and mass, for those radionuclides listed in section 3.3.1,
- Demonstrate that each payload container disposed of at the WIPP contains TRU waste as specified in section 3.3.3, and
- Verify that applicable transportation and facility limits on individual payload containers and assemblies for FGE, PE-Ci, and decay heat are not exceeded, as specified in section 3.3.2, 3.3.4 and 3.3.6.

The radioassay process quantifies at least one of the more prevalent radionuclides known to be present in the waste. The remaining listed radionuclides present in the waste in significant quantities will be identified by direct measurement of isotopic ratios as discussed in section A.2. The isotopic ratios are then used to quantify radionuclides based on the assay value.

The requisite data on isotopic ratios and quantities will be derived from AK (see section A.2), radioassay or both using CBFO approved NDA, instruments and procedures. The AMWTP technically justifies that the AK and/or radioassay techniques, instruments and procedures used:

- are appropriate for the specific waste stream and waste content code descriptions being assayed, and
- will result in unbiased values for the cumulative activity and mass of the WIPP radionuclide inventory.

The AMWTP uses NDA techniques to quantify the radionuclides entrained in the TRU waste drums. Two Retrieval Drum Assay Systems (RDAS) are used. The RDAS are designed to accommodate both 55-gallon and 83/85-gallon drums. The measurement techniques used with the drum assay systems are passive neutron multiplicity counting, active neutron counting using the differential die-away (DDA) technique, gamma-ray isotopic analysis and quantitative gamma-ray energy analysis. The high-efficiency passive neutron analysis provides measurement of most matrix types in the waste processed by the AMWTP. Active neutron analysis supplements the passive approach for certain waste forms and provides better detection limits for low-activity waste containers. The high-resolution gamma-ray measurements provide direct information on the isotopic composition of the plutonium (Pu), uranium (U), americium (Am), and other isotopes in the waste or isotopic ratios. The integrated information from the neutron measurements, gamma-ray measurements, and Acceptable Knowledge (AK) are used to determine the isotopic material composition, quantify the radionuclide masses, and compute the associated derived quantities for each payload container.

AMWTP will not use existing radioassay data collected prior to the implementation of a quality assurance program pursuant to 40 CFR §194.22(a)(1) to characterize and certify payload containers for disposal at WIPP.

Proposals for alternative approaches to identification and quantification of radioisotopes (e.g., quantification of isotopic ratio AK on a waste stream basis) must be submitted to CBFO for review and approval. CBFO will report such proposals to EPA for consideration prior to issuing approval.

A.2 Radionuclide Isotopic Ratios

Establishing isotopic ratios for use in quantifying radionuclides is performed by direct measurement of each container using the AMWTP Drum Assay Systems (DASs). Sites may opt to qualify AK as permitted by 40 CFR §194.22(b) by performing confirmatory testing using WIPP-certified radioassay systems. The AMWTP performs an assay on each container characterized for disposal at WIPP. When direct measurements of isotopic ratios does not yield useable data as a result of technical reasons (e.g., lack of sufficient signal or poor counting statistics), AK is used. All such instances will be documented and appropriately dispositioned.

A.2.1 Methods for Confirmation of Isotopic Ratio AK

As a minimum, to confirm existing AK data, it is necessary to compare the ratio of the two most prevalent radionuclides in the isotopic mix. For weapons and reactor grade plutonium, these are typically ^{239}Pu and ^{240}Pu. For heat source waste, the predominant radionuclides are typically ^{238}Pu and ^{239}Pu. Measured isotopic ratios for ^{241}Am may confirm existing AK by waste stream. However, due to the fluctuation of ^{241}Am in certain waste streams, it may become necessary to measure ^{239}Pu to ^{241}Am isotopic ratios on all containers in that waste stream.

^{241}Am is the daughter of ^{241}Pu, which decays with a half-life of about 14 years. If the time since the chemical separation of the plutonium is known, the quantity of measured ^{241}Am can be used to calculate the quantity of ^{241}Pu. This assumes there was no ^{241}Am in the waste just after the chemical separation and that no ^{241}Am was added to or removed from the waste during the time since the separation. Since ^{241}Am is an indirect measurement of ^{241}Pu, it could be compared (by ratio) to any plutonium isotope (^{239}Pu or ^{240}Pu) associated with weapons and reactor grade plutonium.

For weapons grade and reactor grade waste, isotopic ratio values for ^{238}Pu can be assumed to be valid in AK data if the values for ^{239}Pu and ^{240}Pu have been confirmed. Because ^{242}Pu cannot be measured using NDA methods, the contribution of ^{242}Pu isotopic ratio is calculated by correlation techniques.

For some of the generator sites that were involved primarily in weapons production, the fissile isotopes ^{235}U and ^{233}U and the fissionable isotope ^{238}U may not have been measured when the transuranic waste was originally assayed (i.e., using non-WIPP-certified systems), primarily because the plutonium isotopes were the radionuclides of interest to the generator site. However, other forms of AK may be available. If so, then the AK can be confirmed by data generated on a WIPP-certified system. If valid AK does not exist, then the data generated on a WIPP-certified system can only be used to detect or calculate ^{238}U, ^{235}U, and ^{233}U or to confirm their absence. Because ^{234}U cannot be measured using NDA methods, the isotopic ratios for ^{234}U may be calculated from the ^{235}U enrichment. Values, or lack thereof, for ^{137}Cs can be confirmed by the data generated on a WIPP-certified system. This is typically done by measuring ^{137}Cs directly, or by comparing the NDA measured ^{241}Am 662 keV peak to the other ^{241}Am peaks (e.g., the 125 keV or 721 keV peaks) to determine if the 662 keV peak's intensity is consistent with the expected ^{241}Am intensity. A disproportionate response for the 662 keV peak relative to the other ^{241}Am peaks may indicate the presence of ^{137}Cs. ^{90}Sr may be calculated from the value for ^{137}Cs and AK. If detected, a waste container's concentration of ^{137}Cs can be used to derive a value of ^{90}Sr, through the application of the appropriate scaling factor(s). All scaling factors used will be technically sound and based on known, documented relationships or correlations. The data report for the waste containers for which the ^{90}Sr, value is derived in this manner shall reflect the use of a scaling factor(s) and provide sufficient documentation to enable its independent calculation. Finally, the gamma spectra must be carefully examined for significant presence of other radionuclides to ensure compliance with transportation requirements. Data obtained for radionuclides other than the WIPP-tracked radionuclides presented above are required to address confounding isotope issues (i.e., masking) with regard to NDA.

The technique used to confirm that the absence or the ratio of non-measurable radionuclides are valid for the radioassay method used to confirm AK are documented in RPT-TRUW-03, *Drum Assay Technical Review Report.*

A.2.2 Acceptable Knowledge (AK) Documentation

The use of AK information concerning the radiological composition of a waste stream will be documented either in the AK summary report for the waste characterization of the waste stream or in another controlled document approved by the Site Project Manager. Should this information be contained in AK package(s) prepared to meet other general waste characterization requirements, it need not be duplicated in other controlled documents that address the radiological properties of the waste stream; however, all relevant information must be included in the AK record. The AMWTP AK process is controlled and documented in accordance with MP-TRUW-8.13, *Collection, Review, Confirmation, and Management of AK*. The following discussion is included for the sake of completeness.

A.2.2.1 Required Elements

This section identifies the required radiological information that each TRU waste generating site or measurement facility must maintain for a waste stream. A TRU waste generator site or waste characterization facility may use AK to delineate the distribution of the 10 WIPP-tracked radioisotopes within a TRU waste stream and the presence or absence of isotopes. The type and quantity of supporting documentation may vary by waste stream and shall be compiled in a written record that shall include a summary identifying all sources of information used to delineate the waste stream's isotopic distribution. The basis and rationale for the delineation shall be clearly summarized in an AK report and traceable to referenced documents. Assumptions made in this delineation shall be identified. The following information shall be included as part of the AK written record:

- Map of the site with the areas and facilities involved in TRU mixed waste generation, treatment, and storage identified
- Facility mission description as related to radionuclide-bearing materials and their management, e.g., routine weapons production, fuel research & development and experimental processes
- Description of the specific site locations (such as the area or building) and operations relative to the isotopic composition of the TRU wastes they generated, e.g., plutonium recovery, weapons fabrication, pyrochemical operations and waste incineration
- Waste identification or categorization schemes used at the facility relevant to the waste material's isotopic distribution, e.g., the use of codes that correlate to a specific isotopic distribution, and a description of the isotopic composition of each waste stream
- Information regarding the waste's physical and chemical composition that could affect the isotopic distribution, e.g., processes used to remove ingrown ^{241}Am or alter its expected contribution based solely on radioactive decay kinetics

- Statement of all numerical adjustments applied to derive the material's isotopic distribution, e.g., scaling factors, decay/ingrowth corrections and secular equilibrium considerations

- Specification of the isotopic ratios for the 10 WIPP-tracked radionuclides (^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs) and, if applicable, the radionuclides that comprise 95% of the radiological hazard on a waste stream, waste stream subpopulation, or container basis.

A.2.2.2 Supplemental Acceptable Knowledge Information

Each generator site or measurement facility shall obtain supplemental AK information, dependent on availability. The amount and type of this information cannot be mandated, but sites shall collect information as appropriate to support their contention regarding the waste's isotopic distribution. This information will be used to compile the waste's AK written record. Supplemental AK documentation that may be used includes, but is not limited to, information from the following sources:

- Safeguards & Security, Materials Control & Accountability and other nuclear materials control systems or programs and the data they generated

- reports of nuclear safety or criticality, or accidents/excursions involving the use of special nuclear material (SNM) or nuclear material

- waste packaging, waste disposal, building or nuclear material management area (NMMA) logs or inventory records, and site databases that provide information on SNM or nuclear materials

- test plans, research project reports or laboratory notebooks that describe the radionuclide content of materials used in experiments

- information from site personnel (e.g., documented interviews)

- historical analytical data relevant to the isotopic distribution of the waste stream

A.2.2.3 Discrepancy Resolution

If there is a discrepancy between AK information related to isotopic ratios or composition, the site will evaluate the sources of the discrepancy to determine if the discrepant information is credible. Information that is not credible or information that is limited in its applicability to WIPP characterization will be identified as such and the reasons for dismissing it will be justified in writing in accordance with management procedure, MP-TRUW-8.13, *Collection, Review, Confirmation, and Management of Acceptable Knowledge Documentation*. Limitations concerning the information will be documented in the AK record and summarized in the AK report. In the event that the discrepancy cannot be resolved, the site will perform direct measurements for the impacted population of containers.

If discrepancies result in a change to the original determinations, the AK summary will be updated.

A.3 Data Quality Objectives

The data quality objectives for WIPP certifiable radiological characterization data are established in section 3.3 of the WAC. They are summarized below in table A-3 as they apply to individual payload containers. The AMWTP does not use Radiochemistry (RC) or calorimetry methods to characterized TRU waste for disposal at WIPP.

Table A-3
Data Quality Objectives for Radioassay

Requirement	DQO	Confidence[a]
TRU α-activity concentration > 100 nCi/g	A > LLD	N/A
Fissile mass $\leq$ 200 FGE (55-gallon drums)	$FGE + 2\sigma_{TMU}(FGE) \leq 200$	97.5%
Fissile mass $\leq$ 325 FGE (SWBs and TDOPs)	$FGE + 2\sigma_{TMU}(FGE) \leq 325$	97.5%
Decay heat $\leq$ TRAMPAC limit	$DH + 1\sigma_{TMU}(DH) \leq L_{TRAMPAC}$	84%

[a]Confidence means the statistical level of confidence that the limit is exceeded or not exceeded depending on the requirements of the individual data quality objectives. The confidence is derived from the specified DQOs which assume contributions to TMU are normally distributed.

There are no stipulated data quality objectives for PE-Ci or individual isotope activities (except as they impact the requirements listed above). However, at a minimum, radioassay programs must be capable of identifying, measuring, and reporting the presence or absence of:

- the ten radionuclides identified in section 3.3.1 for tracking of the WIPP radionuclide inventory (see section A.2.1),
- ^{235}U, in order to calculate FGE, as required in section 3.3.2 for compliance with transportation requirements, and
- other radionuclides whose presence contribute to 95% of the radioactive hazard, as specified in section 3.3.1, for compliance with transportation requirements.

In support of the above requirements, the *Canberra Site Acceptance Test Reports (SATR)* for the *Integrated Waste Assay Systems, CI-IDA-NDA-0051 and CI-IDA-NDA-0052* documents and provides technical justification for the following determinations.

Lower Limit of Detection: The lower limit of detection (LLD) for the DAS has been determined. Only DAS measurement modalities that have an LLD of 100 nCi/g or less are used to perform TRU/low-level waste discrimination measurements. Background and container specific interferences are factored into LLD determinations. The LLD is that level of radioactivity which, if present, yields a measured value greater than the critical level with a 95% probability, where the critical level is defined as that value which measurements of the background will exceed with 5% probability. Because the LLD is a measurement-based parameter, it is not feasible to calculate LLDs for radionuclides that are not determined primarily by measurement, e.g., Sr-90. In such cases, the AMWTP has derived and documented the equivalent of an LLD, i.e., a reporting threshold for a radionuclide(s), when it is technically justified. For purposes of reporting radionuclide data in the WWIS, this value will be the equivalent of an LLD. References A3 and A4 provide information in developing the LLD.

Total Measurement Uncertainty (TMU): The method used to calculate the TMU for the quantities in table A-3 must be documented and technically justified in the Canberra Industries, *Total Measurement Uncertainty for the AMWTP Integrated Waste Assay Systems*, CI-IDA-NDA-0055. Compliance with this requirement will be evaluated in reviews of the TMU documentation package for each assay system by CBFO. General guidance for determining the TMU is provided in references A5 and A6.

Calibration Procedures and Frequencies: Each DAS (references A21 through 32) has been calibrated before initial use. During calibration or re-calibration, system correction factors are established and algorithms adjusted such that the value of %R is set as close to 100% as possible, i.e., the system is calibrated to approximately 100%R. The range of applicability of system calibrations is specified in SATR. The matrix/source surrogate waste combination(s) used for calibration are representative of the

- activity range(s) or gram loading(s), and
- relevant waste matrix characteristics (e.g., densities, moderator content, container size) planned for measurement by the system.

Calibration(s) shall be performed in accordance with consensus standards, where applicable. If consensus standards are not used, full documentation of the calibration technique is provided to and approved by CBFO prior to performing WIPP related assays. Primary calibration standards shall be obtained from suppliers maintaining a nationally accredited measurement program. When primary standards are not available, the standards are correlated with primary standards obtained from a nationally accredited measurement program

Calibration Verification: Notwithstanding the need to calibrate individual components for replacement, changes or adjustments (e.g., energy calibration of a detector), verification of the DAS calibration is performed after any one of the following occurs:

- major system repairs and/or modifications
- replacement of the measurement system's components, e.g., detector, neutron generator or supporting electronic components that have the capacity to affect data
- significant changes to the system's software
- relocation of the system

Calibration verification shall consist of demonstrating that the system is within the range of acceptable operation. Secondary standards can be used for the calibration verification if their performance has been correlated with the calibration standard. If a verification of the measurement system's calibration or other test demonstrates that the system's response has significantly changed, a re-calibration of the system shall be performed. Calibrated verification tests, along with acceptance criteria are detailed work instruction, INST-TRUW-8.1.1, *Drum Assay Post Maintenance Calibration & Verification.*

Calibration Confirmation: In order to confirm that the calibration of each DAS was correctly established, the accuracy and precision of each DAS are determined after each calibration or re-calibration by performing replicate measurements of a non-interfering matrix. Calibration confirmation replicate measurements are performed on containers of the same nominal size as those in which actual waste is assayed and according to work instruction, INST-OI-14, *Drum Assay Operations*. The number of replicate measurements to be performed is documented and technically justified. The replicate measurements are performed using nationally recognized standards, or certified standards derived from nationally recognized standards that span the range of use. The standards used to calculate accuracy are not the same as those used for the system calibration. Accuracy is reported as percent recovery (%R). The applicable range for accuracy shall not exceed $\pm$ 30% on a non-interfering matrix. Precision is reported as percent relative standard deviation (% RSD). The %RSD shall not exceed the values listed in Table A-3.2 for the corresponding number of replicate measurements in a non-interfering matrix. Calibration confirmation tests are conducted and documented in accordance with work instruction, CI-IDA-NDA-0035, *Calibration Verification & Confirmation Procedure for the Integrated Waste Assay System (IWAS) at AMWTP and SATR.*.

Table A-3.2
Upper Limits for %RSD vs. Number of Replicates

Number of Replicates	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Max %RSD[a]	1.8	6.6	10.0	12.3	14.0	15.2	16.2	17.1	17.7	18.3	18.8	19.3	19.7	20.0

[a] The values listed are derived from the measured standard deviation of the replicate measurements using $\frac{s}{\mu} \bullet 100\% < \sqrt{\frac{(0.292) \bullet \chi^2_{0.05,n-1}}{n-1}} \bullet 100\%$ where s is the measured standard deviation, n is the number of replicates, μ is the true value, $\chi^2_{0.05,n-1}$ is the critical value for the upper 5% tail of a one sided chi-squared distribution with n-1 degrees of freedom, and 0.292 corresponds to a 95% upper confidence bound on the true system precision limit of 29.2%.

A.4 Quality Control

Section 4.0 of this AMWTP Certification Plan summarizes the QA requirements relating to waste characterization, certification, and transportation that meet all applicable requirements of the CBFO QAPD. The AMWTP DAS uses calibration and operating procedures that have been written, approved, and controlled. Noncomforming items and processes that do not meet established criteria are identified, controlled and corrected in accordance with MP-Q&SI-5.4, *Identification of Nonconforming Conditions* and MP-Q&SI-5.3, *Corrective Action*.

A.4.1 General Requirements

Radioassay Training: Only appropriately trained and qualified personnel are allowed to perform radioassay and data validation/review. Standardized Training requirements for radioassay personnel are based upon existing industry standardized training requirements (e.g., ASTM C1490, *Standard Guide for Selection, Training and Qualification of Nondestructive Assay [NDA] Personne*l [reference A8]) and meets the specifications in the QAPD. Requalification of radioassay personnel shall be based upon evidence of continued satisfactory performance and must be performed at least every two years. Personnel receive training requisite with their activities and level of responsibility in accordance with MP-RTQP-14.4, *Personnel Qualification and Certification.* The period of effectiveness for qualification and the requalification criteria are also specified.

Software QC Requirements: All computer programs and revisions thereof used for radioassay meet the applicable requirements in the QAPD (reference A2, section 6.0) and are performed in accordance with MP-CD&M-11.2, *Software Quality Assurance.*

*Comparison Program*s: The AMWTP participates in any relevant measurement comparison program(s) sponsored or approved by the CBFO. Such programs may be conducted as part of the NDA performance demonstration program (PDP) (references A7 and A10) or through other third parties. (Reference: WIPP Compliance Certification Application including Annual Reports to the EPA).

A.4.2 NDA QC Requirements

The assay procedures cited in various American Society for Testing and Materials (ASTM) and American National Standards Institute (ANSI) standards (references A9, A11-A15) and NRC standard practices and guidelines (reference A16) as referenced in this appendix are recommended for use at all testing facilities.

*Background Measurement*s: Background measurements are performed and recorded at least once per operational day, unless otherwise approved by CBFO. Contributions to background due to radiation from nearby radiation producing equipment, standards or wastes are engineered into the facility and DAS design and controlled in accordance with work instruction, INST-OI-14, *Drum Assay Operations.*

Instrument Performance Measurements: Performance checks on the calibrated and operable DAS (both gamma and neutron modalities) are performed and recorded described in work instruction, INST-OI-14, *Drum Assay Operations*. Performance checks shall include daily efficiency checks and checks for spectrometric instruments, peak position and resolution checks and weekly matrix correction.

A Standardization Check is performed prior to assaying each waste container. The Standardization Check is performed by extending the Add-A-Source prior to loading a waste container and performing passive neutron and gamma-ray measurements. The results of the Standardization Check are compared against established criteria to perform efficiency checks and, for the gamma-ray measurement, peak position and resolution checks prior to assaying each waste drum.

At least once per operational week an interfering matrix, loaded with radioactive sources, is assayed in accordance with work instruction, INST-OI-14, *Drum Assay Operations*. The results are evaluated against established criteria to assess the long-term stability of the NDA instrument's matrix correction. Both high interfering and less interfering surrogate waste containers are used with source standards to test the range of the waste and the source loadings being assayed. Over a six-month period, the operating range of the DAS is tested on applicable surrogate waste matrices representative of the waste streams being processed. The interfering surrogate matrix drums are such that the waste characteristics do not change over time.

Radioactive sources used for the performance measurement checks are long-lived, easy to position relative to the detector(s), and of sufficient radioactivity to obtain good results with relatively short count times. Where appropriate, decay-corrected values are used for compliance comparisons.

Data Checks: Background and performance measurements (standardization, daily performance verification, and weekly check with an interfering matrix drum) are evaluated against established criteria at the time of the measurements to determine acceptability of the RDAS. At least once per week, the background and performance measurement results are reviewed and evaluated to monitor performance trends in accordance with management procedure, MP-TRUW-8.8, *Level I Data Validation*. If daily performance checks result in data that are outside the acceptable range, the required responses in table A-4.2 shall be followed.

	Acceptability Range[a]	**Required Response**
Acceptable Range	$\|Data\|^c \leq 2\sigma^b$	No action required.
Warning Range	$2\sigma^b < \|Data\| \leq 3\sigma^b$	If the first performance check rerun is less than 2σ, then proceed with waste assay measurements. If the first performance check rerun is greater than 3σ, then go to the response required for the "Action Range". If the first performance check rerun is between 2σ and 3σ, then make one more performance measurement (i.e., a second run). If that mesurement is less than 2σ, then proceed with waste assay measurements; otherwise go to the reponse for the "Action Range".
Action Range	$\|Data\| > 3\sigma^b$	If a daily performance verification check result from the first run is greater than 3σ or if the Required Response described above leads to the Action Range, then work stops for the affected DAS and the occurrence is documented and appropriately dispositioned (e.g., a non-conformance report is initiated). The DAS is removed from service pending successful resolution of all necessary actions, and all assays performed since the last acceptable daily performance verification check are suspect, pending satisfactory resolution. Recalibration or calibration verification is required prior to returning the system back to service.

[a]Reference A15
[b]"σ" - the standard deviation is only based on the reproducibility of the data check measurements themselves. This is not TMU.
[c]Absolute Value

A.4.3 Radiochemistry QC Requirements

AMWTP does not use Radiochemistry (RC) methods to characterize TRU waste for disposal at WIPP. Assay standards are prepared and used as indicated in the standard test methods.

A.5 Data Management

A.5.1 Data Review and Validation

All radioassay data must be reviewed and approved by qualified personnel prior to being reported. At a minimum, the data must be reviewed by a technical reviewer and approved by the site project manager or their designee(s). Personnel are qualified as specified in MP-RTQP-14.4, *Personnel Qualification and Certification*. The validation process described in MP-TRUW-8.8, *Level I Data Validation*, and MP-TRUW-8.9, *Level II Data Validation,* includes verification that the applicable quality controls specified in section A.4 have been met.

A.5.2 Data Reporting

Radioassay data are reported to the site project office on a testing batch basis. Batches are defined, as a suite of waste containers undergoing radioassay using the same testing equipment. For NDA, the sites shall specify the size of the testing batch as needed, without regard to waste matrix.

The AMWTP submits testing batch data reports (either by the WTS or hard copy) for each testing batch to the site project office, as defined in MP-TRUW-8.8, *Level I Data Validation*. Radioassay testing batch data reports shall consist of the following:

- Testing facility name, testing batch number, container numbers included in that testing batch, and signature release by the site project manager or their designee(s).
- Table of contents
- Background and performance data or control charts for the relevant time period.
- Data validation per the QAPD (reference A2, section 5.3.2) and as described in MP-TRUW-8.8, *Level I Data Validation.*
- Separate testing report sheet(s) for each container in the testing batch that includes

    - Title "Radioassay Data Sheet"
    - Method used for radioassay (i.e., procedure identification)
    - Date of radioassay
    - Activities and/or masses of individual radioisotopes present and their associated TMUs (curies and/or grams)
    - Operator signature/date
    - Reviewer signature/date

Other radiological properties to be documented for each container include:

- Decay heat expressed in Watts (W) and its associated TMU,
- Total ^{239}Pu FGE expressed in grams (g) and its associated TMU
- TRU alpha activity concentration expressed in curies/gram (Ci/g) and its associated TMU, and
- Total ^{239}Pu equivalent activity expressed in curies (Ci).

Radioassay data for each performance check (i.e., daily performance check and weekly interfering matrix performance check) and each container is transferred from the DAS to the WTS. Calculated quantities are included in the radioassay batch data reports.

TMU is reported in terms of one standard deviation on the DAS and the WTS reports.

A.5.3 Data and Records Retention

The following nonpermanent records are maintained at the AMWTP for maintenance, and are documented and retrievable by testing batch number, in accordance with the QAPD:

- testing batch reports
- all raw data, including instrument readouts, calculation records, and radioassay QC results
- all instrument calibration reports, as applicable

A.6 Quality Characteristics Assessment

Per 40 CFR §194.22(c), there are five "quality characteristics" that have to be assessed. These quality characteristics and the method by which they are assessed are described in the following sections.

A.6.1 Data Accuracy

Per 40 CFR §194.22(c)(1), *Data Accuracy* is defined as "the degree to which data agree with an acceptable reference or true value." For the AMWTP NDA methods, this quality characteristic is met and maintained as described in section A.3. The AMWTP does not use RC methods for characterizing CH-TRU waste.

A.6.2 Data Precision

Per 40 CFR §194.22(c)(2), *Data Precision* is defined as "a measure of the mutual agreement between comparable data gathered or developed under similar conditions expressed in terms of standard deviation." For AMWTP NDA methods, this quality characteristic is met and maintained as described in section A.3. The AMWTP does not use RC methods for characterizing CH-TRU waste.

A.6.3 Data Representativeness

Per 40 CFR §194.22(c)(3), *Data Representativeness* is defined as "the degree to which data can accurately and precisely represent a characteristic of a population, a parameter, variations at a sampling point, or environmental conditions." For NDA and RC methods, this quality characteristic for the waste stream is met and maintained through 100% measurement confirmation on a payload container basis. For NDA, since the entire waste container is subjected to measurement, representativeness pertaining to the actual measurement is not applicable. The AMWTP does not use RC methods for characterizing CH-TRU waste.

A.6.4 Data Completeness

Per 40 CFR §194.22(c)(4), *Data Completeness* is defined as "a measure of the amount of valid data obtained compared to the amount that was expected." For NDA methods, this quality characteristic is met and maintained by requiring 100% valid results. For the AMWTP NDA program, any results indicating the NDA measurement was invalid require re-measurement. The AMWTP does not use RC methods for characterizing CH-TRU waste.

A.6.5 Data Comparability

Per 40 CFR §194.22(c)(5), *Data Comparability* is defined as "a measure of confidence with which one data set can be compared to another." For NDA methods, this quality characteristic is addressed by ensuring that all data are produced under the same system of controls. These controls apply to all aspects of the data generation process, including: procurement of analytical instruments; calibration and operation of assay equipment according to industry standards; preparation and use of standardized instrument and data review procedures; and, training of equipment operators and technical/data review personnel to the QAPD, as specified in Section A.4.1. All NDA and RC systems and methods are approved by CBFO prior to use in generating waste characterization data. Additionally, comparison of measured data with AK derived or based values, as applicable, provides a means to assess comparability on a waste stream basis. Although no specific confidence level is specified, these controls provide comparability among all data generated under this program. Sites using radioassay systems shall participate in measurement comparison programs as specified in Section A.4.1.

Appendix A References

A1. U.S. Nuclear Regulatory Commission. *Peer Review for High-Level Nuclear Waste Repositories,* NUREG-1297, Washington D.C., Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission.

A2. U.S. Department of Energy. *Quality Assurance Program Document*. CAO-94-1012. Carlsbad, New Mexico, Carlsbad Area Office, U.S. Department of Energy. http://www.wipp.ws/library/qapd/caoqapd.pdf

A3. Currie, Lloyd A., 1968. Limits for qualitative detection and quantitative determination. *Anal.Chem.* 40: 586-93.

A4. EPA, 1980. *Upgrading Environmental Radiation Data.* EPA 520/1-80-012, Washington D.C., Office of Radiation Programs, U. S. Environmental Protection Agency.

A5. K. C. Smith, R. A. Stroud, K. L. Coop, and J. F. Bresson. 1998. "Total Measurement Uncertainty Assessment for Transuranic Waste Shipments to the Waste Isolation Pilot Plant." Proceedings of the 6th Nondestructive Assay Waste Characterization Conference, Salt Lake City, Utah, Nov. 17-19, 1998, pp.21-37.

A6. K. L. Coop, J. F. Bresson, M. E. Doherty, B. M. Gillespie, and D. R. Davidson. “Standardized Total Measurement Uncertainty Reporting for WIPP”. Nondestructive Assay Interface Working Group, Salt Lake City, Utah, May 22, 2000.

A7. U.S. Department of Energy. *Performance Demonstration Program Plan for Nondestructive Assay of Boxed Wastes for the TRU Waste Characterization Program*. DOE/CBFO-01-1006, Current Revision. Carlsbad, New Mexico, Carlsbad Area Office, U.S. Department of Energy. http://www.wipp.ws/library/pdp/DOE-CBFO-01-1006Rev0.pdf

A8. American Society for Testing and Materials. *Standard Guide for Selection, Training and Qualification of Nondestructive Assay (NDA) Personne*l, ASTM C1490, Annual Book of ASTM Standards, Philadelphia, Pennsylvania, American Society for Testing and Materials.

A9. American National Standards Institute. *Radiometric Calorimeters – Measurement Control Program*, ANSI N15.54, American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

A10. U.S. Department of Energy. *Performance Demonstration Program Plan for Nondestructive Assay of Drummed Wastes for the TRU Waste Characterization Program*. DOE/CBFO-01-1005, Current Revision. Carlsbad, New Mexico, Carlsbad Area Office, U.S. Department of Energy. http://www.wipp.ws/library/pdp/DOE-CBFO-01-1005Rev0.1.pdf

A11. American Society for Testing and Materials. "Standard Test Method for Determination of Plutonium Isotopic Composition by Gamma-Ray Spectrometry." ASTM C1030-95, Annual Book of ASTM Standards, Philadelphia, Pennsylvania, American Society for Testing and Materials.

A12. American Society for Testing and Materials. "Standard Test Method for Nondestructive Assay of Nuclear Material in Scrap and Waste by Passive-Active Neutron Counting Using a 252Cf Shuffler." ASTM C1316-95, Philadelphia, Pennsylvania, American Society for Testing and Materials.

A13. American Society for Testing and Materials. "Standard Test Method for Nondestructive Assay of Special Nuclear Material in Low Density Scrap and Waste by Segmented Passive Gamma-Ray Scanning." ASTM C1133-96, Annual Book of ASTM Standards, Philadelphia, Pennsylvania, American Society for Testing and Materials.

A14. American Society for Testing and Materials. “Standard Test Method for Nondestructive Assay of Plutonium, Tritium and 241 Am by Calorimetric Assay.” ASTM C1458-00, Annual Book of ASTM Standards, Philadelphia, Pennsylvania, American Society for Testing and Materials.

A15. American National Standards Institute. *Nondestructive Assay Measurement Control and Assurance*, ANSI N15.36. American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018

A16. U.S. Nuclear Regulatory Commission. 1984. *Nondestructive Assay of Special* Nuclear *Material Contained in Scrap and Waste.* Regulatory Guide 5.11, Washington, DC, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission.

A17. American National Standards Institute. *Plutonium-Bearing Solids Calibration Techniques for Calorimetric Assay.* ANSI N15.22-1987, American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

A18. Canberra Industries, *Genie 2000 Spectroscopy System Customization Tools,* ICN 9230847F4

A19. Canberra Industries, *NDA 2000 Technical Reference Manual*, ICN 9231595C.

A20. Canberra Industries, *Total Measurement Uncertainty for the AMWTP Integrated Waste Assay Systems*, CI-IDA-NDA-0055.

A21. Canberra Industries, *Neutron Multiplicity Counter Characterization Report for the Integrated Waste Assay System*, Retrieval Unit 1, 34000B.

A22. Canberra Industries, *Neutron Multiplicity Counter Characterization Report for the Integrated Waste Assay System*, Retrieval Unit 2, 34001B.

A23. Canberra Industries, *Differential Die-Away Analysis Characterization Report for the Integrated Waste Assay System,* Retrieval Unit 1, 34002A.

A24. Canberra Industries, *Differential Die-Away Analysis Characterization Report for the Integrated Waste Assay System,* Retrieval Unit 2, 34003B

A.25. Canberra Industries, *Q2 Calibration Report for the Integrated Waste Assay System*, Retrieval Unit 1, 34004A.

A.26. Canberra Industries, *Q2 Calibration Report for the Integrated Waste Assay System*, Retrieval Unit 2, 34005A.

A.27. Canberra Industries, *Site Acceptance Test Reports (SATR) for the Integrated Waste Assay Systems* Retrieval Unit #1 at AMWTP, CI-IDA-NDA-0051.

A.28. Canberra Industries, *Site Acceptance Test Reports (SATR) for the Integrated Waste Assay Systems* Retrieval Unit #2 at AMWTP, CI-IDA-NDA-0052.

A.29. Canberra Industries, *Calibration Verification & Confirmation Procedure for Integrated Waste Assay (IWAS) at AMWTP,* CI-IDA-NDA-0035.

A.30. BNFL Inc., *Drum Assay Technical Review Report*, RPT-TRUW-03.

A.31. BNFL Inc., *Drum Assay Post Maintenance Calibration and Verification,* INST-TRUW-8.1.1.

APPENDIX B

^{239}Pu Equivalent Activity

The concept of ^{239}Pu equivalent activity (PE-Ci) is intended to eliminate the dependency of radiological analyses on specific knowledge of the radionuclide composition of a TRU waste stream. A unique radionuclide composition and/or distribution are associated with most TRU waste streams at each site. By normalizing all radionuclides to a common radiotoxic hazard index, radiological analyses that are essentially independent of these variations can be conducted for the WIPP facility. ^{239}Pu, as a common component of most defense TRU wastes, was selected as the radionuclide to which the radiotoxic hazard of other TRU radionuclides could be indexed.

Modeled operational releases from the WIPP facility, including both routine and accident-related, are airborne. There are no known significant liquid release pathways during the operational phase of the facility. This, and the fact that TRU radionuclides primarily represent inhalation hazards, allows a valid relationship to be established, which normalizes the inhalation hazard of a TRU radionuclide to that of ^{239}Pu for the purpose of the WIPP radiological analyses. In effect, the radiological dose consequences of an airborne release of a quantity of TRU radioactivity with a known radionuclide distribution will be essentially identical to that of a release of that material expressed in terms of a quantity of ^{239}Pu. To obtain this correlation, the 50-year effective whole-body dose commitment or dose conversion factor for a unit intake of each radionuclide will be used.

For a known radioactivity quantity and radionuclide distribution, the ^{239}Pu equivalent activity is determined using radionuclide-specific weighting factors. The ^{239}Pu equivalent activity (AM) can be characterized by:

$$\mathrm{AM} = \sum_{i=1}^{K} A_i / WF_i$$

where K is the number of TRU[1] radionuclides, A_i is the activity of radionuclide i, and WF_i is the PE-Ci weighting factor for radionuclide i.

WF_i is further defined as the ratio

$$WF_i = E_o / E_i$$

where E_o (rem/ μCi) is the 50-year effective whole-body dose commitment due to the inhalation of ^{239}Pu particulates with a 1.0 μm activity median aerodynamic diameter (AMAD) and a weekly pulmonary clearance class, and E_i (rem/ μCi) is the 50-year effective whole-body dose commitment due to the inhalation of radionuclide (i)particulates with a 1.0 μm activity median aerodynamic diameter and the pulmonary clearance class resulting in the highest 50-year effective whole-body dose commitment.

Weighting factors calculated in this manner are presented in table B-1 for radionuclides typically present in CH-TRU waste. If other TRU radionuclides are determined to be present in the payload container, their weighting factors can be obtained from the values of E_o and E_i contained in DOE/EH-0071 (reference B1).

Table B-1
PE-Ci Weighting Factors for Selected Radionuclides

Radionuclide	Pulmonary Clearance Class[a]	Weighting Factor
^{233}U	Y	3.9
^{237}Np	W	1.0
^{236}Pu	W	3.2
^{238}Pu	W	1.1
^{239}Pu	W	1.0
^{240}Pu	W	1.0
^{241}Pu	W	51.0
^{242}Pu	W	1.1
^{241}Am	W	1.0
^{243}Am	W	1.0
^{242}Cm	W	30.0
^{244}Cm	W	1.9
^{252}Cf	Y	3.9

[a](W) Weekly, (Y) Yearly

B.1 Appendix B References

B1. U.S. Department of Energy. *Internal Dose Conversion Factors for Calculation of DOSE to the Public.* DOE/EH-0071, July 1988.

APPENDIX C

Glossary

Acceptable knowledge (AK) - Knowledge used for waste characterization, which is based on the materials and processes used to generate a waste. Acceptable knowledge includes information about the physical form of the waste, the base materials composing the waste (especially hazardous and radioactive materials), and the process that generated the waste. Acceptable knowledge is used to define waste streams, assign summary categories, assign EPA hazardous waste numbers, estimate the weight fraction of CPR, and estimate isotopic ratios.

Activity - A measure of the rate at which a material emits nuclear radiation, usually given in terms of the number of nuclear disintegrations occurring in a given length of time. The common unit of activity is the curie, which amounts to 37 billion (3.7×10^{10}) disintegrations per second. The International Standard unit of activity is the becquerel and is equal to one disintegration per second.

Administrative controls - Provisions relating to organization and management, procedures, record keeping, assessment, and reporting necessary to ensure the safe operation of the facility.

Atomic energy defense activities - Activities of the Secretary of Energy (and predecessor agencies) performed in whole or in part in carrying out any of the following functions: naval reactors development; weapons activities, including defense inertial confinement fusion; verification and control technology; defense nuclear material production; defense nuclear waste and materials by-product management; defense nuclear materials security investigations; and defense research and development.

Authorization basis - Those aspects of the facility design and operational requirements relied upon by DOE to authorize the operation of nuclear facilities and processes.

Characterization - Sampling, monitoring, and analysis—whether by review of AK, nondestructive examination, NDA, RC, headspace gas analysis, or chemical analysis of the volatile or semi-volatile organic compounds or metals—to identify and quantify the constituents of a waste material.

Chemical compatibility - Assessing the properties of chemicals in a payload container (>1 weight percent); there must be no adverse safety or health hazards produced as a result of any mixtures that occur.

Completeness - The percentage of measurements made which are judged to be valid measurements. The completeness goal is to generate a sufficient amount of valid data based on program needs. Valid results for analytical, radioassay, and radiography data are those that were obtained when the laboratory or testing facility demonstrated that the instrumentation and method were in control; that is, that all calibration, verification, interference, and zero matrix checks met acceptance criteria. Valid samples are those collected and submitted for analysis that were representative and met all preservation requirements upon arrival at the laboratory.

Compressed gas - Compressed gases are those materials defined as such by 49 CFR Part 173, Subpart G.

Contact-handled transuranic waste - Transuranic waste with a surface radiation dose equivalent rate not greater than 200 mrem/h.

Content code - A uniform system applied to waste forms to group those with similar characteristics for purposes of shipment in the TRUPACT-II.

Corrosive/Corrosivity - A solid waste exhibits corrosivity if a sample of the waste is either aqueous and has a pH $\leq$2 or $\geq$12.5, or it is a liquid and corrodes steel at a rate >6.35 mm (0.250 inch) per year at a test temperature of 55^0 (130^0F). (40 CFR §261.22)

Curie - A unit of activity equal to 37 billion (3.7×10^{10}) disintegrations per second.

Disposal - Permanent isolation of TRU waste from the accessible environment with no intent of recovery, whether or not such isolation permits the recovery of such waste (reference 2, section 2, subsection 5).

Dose conversion factor - A numerical factor used in converting radionuclide uptake (curies) in the body to the resultant radiation dose (rem).

Dose equivalent rate - The radiation dose equivalent delivered per unit time (e.g., rem per hour).

Fissile gram equivalent - An isotopic mass of radionuclide normalized to ^{239}Pu.

Fissile material - Any material consisting of or containing one or more radionuclides that can undergo neutron-induced fission with neutrons of essentially zero kinetic energy (e.g., thermal neutrons) such as ^{233}U, ^{235}U, and ^{239}Pu.

Hazardous waste - Those wastes which are designated hazardous by EPA (or state) regulations. For a detailed description, see 40 CFR § 261.3. Hazardous wastes are listed in 20.4.1 NMAC, subpart II (40 CFR Part 261) and/or exhibit one of the four characteristics in 20.4.1 NMAC, subpart II (40 CFR Part 261) (i.e., ignitability, corrosivity, reactivity, and toxicity).

Headspace - The total contained volume of a container minus the volume occupied by the waste material.

Headspace gas - The gas within the headspace of a container.

Lower Limit of Detection - The level of radioactivity which, if present, will yield a measured value greater than the critical limit with a 95% probability. The critical limit is defined as that value which measurements of the background will exceed with a 5% probability.

Overpack - A payload container placed around another container to control contamination or to enclose a damaged container.

Package - (1) A packaging plus its contents. (2) The reusable Type B shipping container (i.e., TRUPACT-II) loaded with TRU waste payload containers, which has been prepared for shipment in accordance with the package QA program. (3) In the regulations governing the transportation of radioactive materials, the packaging, together with its radioactive contents, as presented for transport.

Packaging - The reusable Type B shipping container for transport of TRU waste payload containers (i.e., TRUPACT-II).

Packaging quality assurance program - A site-specific document that defines the quality assurance and quality control activities applicable to usage of the NRC-approved packaging. This program shall meet the requirements of 10 CFR Part 71, Subpart H.

Payload container - The outermost container (i.e., drum, SWB, or TDOP) for TRU waste material that is placed in a reusable Type B shipping container (i.e., TRUPACT-II) for transport.

Payload container assembly - An assembly of payload containers, such as a seven-pack of drums, that is intended to be handled and emplaced in the WIPP as a single unit.

Pipe overpack - A packaging configuration consisting of a vented cylindrical pipe component surrounded by dunnage within a vented 55-gallon drum with a rigid polyethylene liner and vented lid.

Plutonium equivalent activity - An equivalent radiotoxic hazard of a radionuclide normalized to ^{239}Pu.

Precision - A measure of mutual agreement among individual measurements of the same property made under prescribed similar conditions; often expressed as a standard deviation or relative percent difference.

Pyrophoric - Materials that may ignite spontaneously in air or that emit sparks when scratched or struck, especially with materials such as steel. A flammable solid that, under transport conditions, might cause fires through friction or retained heat or that can be ignited readily and, when ignited, burns vigorously and persistently so as to create a serious transportation hazard. Included in the pyrophoric definition are spontaneously combustible materials, water reactive materials, and oxidizers. Examples of nonradioactive pyrophorics are organic peroxides, sodium metal, and chlorates.

Radioassay - Methods used to identify and quantify radionuclides in TRU waste. Radioassay includes NDA and RC.

Radiography - A nondestructive testing method that uses x-rays to inspect and determine the physical form of waste.

Radionuclide - A nuclide that emits radiation by spontaneous transformation.

Residual liquid - Liquids in quantities of less than 1 volume percent of the waste payload container that result from liquid residues remaining in well-drained internal containers, condensation of moisture, and liquid separation resulting from sludge/resin setting.

Shipper - A TRU waste site that releases a TRUPACT-II to a carrier for shipment.

Shipping category - A shipping category is defined by the following parameters: chemical composition of the waste (waste type), gas generation potential of the waste material type (quantified by the g-value for hydrogen), and gas release resistance (type of payload container and type and maximum number of confinement layers used).

Sites - Department of Energy TRU waste generator/storage sites.

Standard waste box - A metal payload container authorized for use within the TRUPACT-II packaging, that has been tested by DOE to meet DOT Specification 7A Type A requirements.

Ten-drum overpack - A metal payload container authorized for use within the TRUPACT-II packaging, that has been tested by DOE to meet DOT Specification 7A Type A requirements.

Test Category - Payload containers that do not meet the analytical category limits are classified as test category. (TRAMPAC, revision 19, section 5.2)

Trace chemicals/materials - Chemicals/materials that occur individually in the waste in quantities less than 1 weight percent. The total quantity of trace chemicals/materials not listed as allowed materials for a given waste material type in any payload container is restricted to less than 5 weight percent. (TRAMPAC, revision 19, section 4.3.1)

TRU isotope - An isotope of any element having an atomic number greater than uranium (i.e., 92).

TRU waste - Waste containing more than 100 nCi of alpha-emitting TRU isotopes per gram of waste, with half-lives greater than 20 years, except for (1) high-level radioactive waste, (2) waste that the Secretary has determined, with the concurrence of the Administrator, does not need the degree of isolation required by the disposal regulations, or (3) waste that the NRC has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61. (Land Withdrawal Act, section 2, subsection 18)

TRU mixed waste - TRU waste that is also a hazardous waste as defined by the Hazardous Waste Act and 20.4.1.200 NMAC (incorporating 40 CFR § 261.3). (Hazardous Waste Facility Permit, module I, section I.D.6)

TRUCON content codes - (1) The document containing a description of the waste stream, waste form, and package configuration for each waste content code authorized for shipment in TRUPACT-II containers. (2) A type of shorthand representation of the chemical content and physical waste form of generator waste streams for use in the transportation safety analyses.

TRUPACT-II - An NRC-certified Type B transportation packaging used for transportation of CH-TRU wastes.

TRUPACT-II Authorized Methods for Payload Control (TRAMPAC) - The TRAMPAC is the governing document for payload shipments in the TRUPACT-II. (TRAMPAC, section 1.0)

Verification - The act of authenticating or formally asserting the truth that a process, item, data set, or service is, in fact, that which is claimed. Data verification is the process used to confirm that all review and validation procedures have been completed.

Volatile organic compounds - For the purposes of the TRU waste program, those RCRA-regulated VOCs listed in the WIPP WAP and any additional compounds tentatively identified by VOC analytical procedures used to satisfy program requirements (i.e., any compound containing carbon and hydrogen with any other element that has a vapor pressure of 77.6 mL of mercury (1.5 psia) or greater under actual storage conditions).

Waste acceptance criteria - Constraints (limits) on the physical, chemical, and radiological properties of TRU waste and its packaging as determined by WIPP's authorization basis requirements. TRU waste will not be approved for shipment to and disposal at the WIPP until it has been certified as meeting these criteria. Waste acceptance criteria ensure that CH-TRU waste is managed and disposed of in a manner that protects human health and safety and the environment.

Waste analysis plan - The waste analysis plan includes test methods, details of planned waste sampling and analysis, a description of the waste shipment screening and verification process, and a description of the QA/QC program. Sites are required to implement the applicable requirements of the WIPP WAP. (Hazardous Waste Facility Permit, attachment B)

Waste characterization - The process of determining that TRU waste meets the requirements of the WAC by the acceptable performance of the activities defined by CBFO-approved site-specific plans.

Waste certification - Formal and documented declaration by sites that waste has been characterized and meets the requirements of the WIPP WAC.

Waste stream - A waste stream is waste material generated from a single process or from an activity which is similar in material, physical form, and hazardous constituents (Hazardous Waste Facility Permit, attachment B).

APPENDIX D

Payload Container Integrity

The operator is to visually examine 100% of the payload container exterior to determine if the payload container meets the criteria of Section 3.2.1. At a minimum, sites shall incorporate the questions and criteria contained in the following checklist into applicable site procedures. This payload container inspection shall be performed and documented as a part of the TRUPACT-II loading process. Any YES answer on the inspection checklist will result in the operator discontinuing the inspection, marking the payload container as unacceptable for shipment, and removal of the payload container from the shippable inventory. Before the rejected container can be shipped, it must undergo appropriate corrective actions (e.g., evaluation, repackaging, overpacking, etc.), as applicable. All containers must have an acceptable and complete inspection checklist documenting that it meets the DOT 7A criteria.

CONTAINER EXAMINATION	DISCUSSION OF CRITERIA	COMPLIANCE	
Is the payload container obviously degraded?	Obviously degraded means clearly visible and potentially significant defects in the payload container or payload container surface.	YES	NO.
Is there evidence that the payload container is, or has been, pressurized?	Pressurization can be indicated by a fairly uniform expansion of the sidewalls, bottom or top. Past pressurization can be indicated by a notable outward deflection of the bottom or top. Verify that the drum is not warped.	YES	NO

CONTAINER EXAMINATION	DISCUSSION OF CRITERIA	COMPLIANCE	
3. Is there any potentially significant rust or corrosion such that wall thinning, pin holes, or breaches are likely or the load bearing capacity is suspect?	Rust shall be assessed in terms of its type, extent, and location. Pitting, pocking, flaking, or dark coloration characterizes potentially significant rust or corrosion. This includes the extent of the payload container surface area covered, thickness, and, if it occurs in large flakes or built-up (caked) areas. Rusted payload containers may not be accepted if: • Rust is present in caked layers or deposits • Rust is present in the form of deep metal flaking, or built-up areas of corrosion products In addition, the location of rust should be noted; for example on a drum: top lid; filter region; locking chine; top one-third, above the second rolling hoop; middle one-third, between the first and second rolling hoops; bottom one-third, below the second rolling hoop; and on the bottom. Payload containers may still be considered acceptable if the signs of rust show up as: • Some discoloration on the payload container • If rubbed would produce fine grit or dust or minor flaking (such that wall thinning does not occur)	YES	NO
4. Are any of the following apparent? • wall thinning • pin holes • breaches	Wall thinning, pin holes, and breaches an be a result of rust/corrosion (see discussion for #3).	YES	NO
5. Are there any split seams, tears, obvious holes, punctures (of any size), creases, broken welds, or cracks?	Payload containers with obvious leaks, holes or openings, cracks, deep crevices, creases, tears, broken welds, sharp edges or pits, are either breached or on the verge of being breached. Verify that there is no warpage that could cause the container to be unstable or prevent it from fitting properly in the TRUPA CT-II	YES	NO
6. Is the load-bearing capacity suspect?	The load-bearing capacity could be reduced for excessive rust (see discussion for #3), wall thinning (see discussion for #4), breaches, cracks, creases, broken welds, etc. (see discussion for #5)	YES	NO

CONTAINER EXAMINATION	DISCUSSION OF CRITERIA	COMPLIANCE	
7. Is the payload container improperly closed?	Inspect the fastener and fastener ring (chine) if applicable for damage or excessive corrosion. Check the alignment of the fastener to ensure that it is in firm contact around the entire lid and the payload container will not open during transportation.	YES	NO
8. Are there any dents, scrapes, or scratches that make the payload container's structural integrity questionable or prevent the top and bottom surfaces from being parallel?	Deep gouges, scratches, or abrasions over wide areas are not acceptable. If top and bottom surfaces are not parallel, this would indicate that the container is warped. Dents should be less than ¼ inch deep by 3 inches long and between ½ inch to 6 inches wide. All other dents must be examined to determine impact of structural integrity	YES	NO
9. Is there discoloration which would indicate leakage or other evidence of leakage of material from the payload container?	Examine the payload container regions near the filter vents, top lid fittings, bottom fittings, welds, seams and intersections of one or more metal sheets or plates. Payload containers must be rejected if evidence of leakage is present	YES	NO
10. Is the payload container bulged?	For the purposes of this examination, bulging is indicated by: • A fairly uniform expansion of the sidewalls, bottom, or top (e.g., in the case of a drum, either the top or bottom surface protrudes beyond the planar surface of the top or bottom ring, • A protrusion of the side wall (e.g., in the case of a drum, beyond a line connecting the peaks of the surrounding rolling hoops or a line between a surrounding rolling hoop and the bottom or top ring), or • Expansion of the sidewall (e.g., in the case of a drum, such that it deforms any portion of a rolling hoop).	YES	NO

References

INEEL Engineering Design File "*Waste Container Integrity Evaluation for Storage"*, EDF-RWMC-705, September 25, 1996. Idaho National Engineering and Environmental Laboratory, Idaho Falls, ID.

Title 49 CFR Part 173, Subpart 475. "Quality Control Requirements Prior to Each Shipment of Class 7 (Radioactive) Materials." *Code of Federal Regulations,* Washington, D.C., Office of the Federal Register, National Archives and Records Administration.

DOE/RL-96-57, Section 2.5.5. "Test & Evaluation Document for the U. S. Department of Transportation Specification 7A type to Packaging. (Formerly WHC-EP-0558).